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CLINICAL MANUAL.

CLINICAL MANUAL

FOR INDIA

COMPILED FOR THE USE OF THE STUDENTS
OF THE MADRAS MEDICAL COLLEGE.

BY

SURGEON-MAJOR-GENERAL C. SIBTHORPE, C.B., F.K.Q.C.P., M.R.I.A.,
Fellow of the University of Madras.

FOURTH EDITION.

REVISED AND PARTLY RE-WRITTEN BY VARIOUS
AUTHORS.

MADRAS:
PUBLISHED BY THE SUPERINTENDENT, GOVERNMENT PRESS.

1897.

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PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS.

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PREFACE TO THE FOURTH EDITION.

The third edition of the Manual having become exhausted, the preparation of a fourth edition has become necessary.

In a letter to the Government of Madras, dated 8th September 1894, Surgeon-Major-General C. Sibthorpe proposed to hand over his interest in the Clinical Manual to the Government of Madras on the condition that the Principal of the Medical College and the College Council would undertake the re-editing of the book, and that any profit from its sale should be devoted to founding a prize for the students of the Medical College, the rules and conditions for this to be left to the College Council to determine.

The Government of Madras in G.O., No. 184, Educational, dated 1st March 1895, accepted the liberal offer of the Surgeon-General with thanks, and the Council of the Medical College appointed a small committee to undertake the revision of the work. The following officers have either revised or re-written the various articles in the present edition, viz. :—

Surgeon-Captain A. E. Grant.	Part I, Chapters I, II, IV, IX, X, XI, XXI.
Surgeon-Lieutenant-Colonel J. Maitland.	Part I, Chapters III, VII, XVI, XVII. Part II, Chapter II.
Surgeon-Major D. F. Dymott.	Part I, Chapters VIII, XXII, XXIII.
Surgeon-Major J. Smyth ..	Part I, Chapters XIII, XIV. Part II, Chapters I, III.
Surgeon-Captain G. G. Giffard.	Part I, Chapters V, VI. Part II, Chapter VIII.
Surgeon-Captain D. Simpson.	Part I, Chapter XII.

Surgeon-Captain R. H. Elliot.	Part I, Chapter XV. Part II, Chapter IV.
Surgeon-Major R. Ross ..	Part II, Chapter IV. Note on Malarial Parasite.
Brigade-Surgeon-Lieutenant-Colonel A. M. Branfoot.	Part I, Chapters XVIII, XIX. Part II, Chapter VI.
Surgeon-Major J. L. Van-Geyzel.	Part II, Chapter V.
Surgeon-Captain R. Robertson	Part II, Chapter VII.
Surgeon-Captain C. H. Leet Palk.	Part I, Chapter XX.

In carrying out the work of revision, the committee have kept before them the importance of condensing the matter contained in the book as much as possible, in order to keep it within the limits of a useful clinical manual. The chapters have been entirely re-arranged, and that on hospital statistics has been omitted, the subject being embodied in the Civil Medical Code.

On the other hand, some new matter, on important subjects such as the malarial parasite, &c., has been added, and other chapters have been amplified and brought up more to the knowledge of the present time.

A. M. BRANFOOT, M.B.,
President of the Revision Committee.

J. MAITLAND, M.D.,
J. SMYTH, M.D.,
Members of the Revision Committee.

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PREFACE TO THE FIRST EDITION.

In the year 1878 a small book was compiled by Surgeon A. M. Branfoot, M.B., with the assistance of the other members of the Hospital Staff, containing the formulæ in use in the General Hospital. All the copies of this work having been sold in 1880, at the suggestion of several brother-officers and with the assistance of Surgeon C. J. MacNally, M.D., I commenced its revision for another edition.

Several new formulæ, copies of the hospital rules regarding the dispensing of medicines and the distribution of diets, were included. I also added some directions regarding the clinical examination of patients, and other matter, from notes made at different times while I have acted as a clinical teacher. The Surgeon-General with the Government of Madras thanked me officially for the preparation of the work, and suggested to the Revenue Board that it should be supplied to the Civil Dispensaries throughout the Presidency; this has been done to a considerable extent.

In the present edition a great deal of new matter has been added with the hope of making it a more complete and practical Hospital Manual. In compiling it the source of the information has been given as fully as possible, but there must be many omissions as it is not always easy to say from whence a particular idea has been acquired.

I take this opportunity of thanking several of my brother-officers for many valuable suggestions and much assistance, particularly Surgeon-Major R. W. Cockerill, Professor of Surgery, for revising the chapter on taking

Surgical cases; Surgeon-Major E. F. Drake-Brockman, F.R.C.S., Professor of Ophthalmology, and Surgeon A. M. Branfoot, M.B., Professor of Midwifery, for the kind manner in which they acceded to my request to contribute a chapter on the clinical aspects of their own subjects; Surgeon J. Maitland, M.B., for his useful chapter on the antiseptic method of Surgical Dressing and for much willing help in correcting the proofs, and Surgeon Youngerman for checking some of the calculations.

The illustrations have been well copied by Mr. Paczensky, of the Mount Road, Madras.

C. SIBTHORPE, F.K.Q.C.P.,
Surgeon-Major, I.M.S.

Fort St. George,
Madras, *January* 1883.

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CLINICAL MANUAL

COMPILED FOR THE USE OF STUDENTS AT THE MADRAS MEDICAL COLLEGE.

PART I.

ON CLINICAL STUDY AND THE CLINICAL EXAMINATION OF PATIENTS.

CHAPTER I.

CLINICAL STUDY.

THE object of clinical instruction is to teach students how to investigate the phenomena of disease and how to find out, when possible, the cause of any departure from the standard of health, so that they may be able to direct their treatment to the removal of the cause and the alleviation of the symptoms present. This is the science and art of *diagnosis*, and all *rational* treatment is founded on accurate diagnosis. The training suggested in this book, which is founded on that laid down in the College regulations, is worked out with the view of preventing our students from becoming *routine* practitioners who treat a disease as they have been told that an affection bearing such a name should be treated, and to keep them from lapsing into the error of only treating symptoms.

For the due appreciation of the signs and symptoms of disease, it is necessary that they should be accurately observed. With this view it is important that students should carefully cultivate their senses and learn to use all the instruments which have been invented to aid them. They should also learn to apply the simple chemical tests and analyses which are made use of in clinical medicine.

Course of clinical study.—The courses of *clinical study* laid down for the different classes of students of the College and Apothecary departments of the College vary very little, and are founded ont he bye-laws of the University of Madras.

The students for the M.B. and C.M. Degrees must have passed the F.A. Examination, and are required to pass a preliminary scientific examination in Inorganic Chemistry, Experimental Physics, Botany and Practical Chemistry before they are permitted to commence their proper professional training.* The next two years have to be devoted to the study of Comparative Anatomy, Human Anatomy, Physiology, Materia Medica and Therapeutics, Practical Pharmacy, Organic Chemistry and Practical Organic Chemistry. During this period their *clinical training* consists in attendance on the out-patient department of one of the clinical hospitals in their first year of study, and in attendance for equal periods on the clinical practice in the medical and surgical wards of a recognised hospital in their second year. At the end of the second year of study they are required to pass an examination in the above subjects, with the exception of the clinical work, before proceeding to their third year's course of study.

If successful at their first examination, they are permitted to commence their third year's course, and during it and the one following it, they have to devote themselves to the study of Medicine and Medical Anatomy, Surgery and Surgical Anatomy, Midwifery and Diseases of Women and Children, Ophthalmology, Hygiene, Medical Jurisprudence, General Pathology and the making of *post-mortem* examinations, and Minor and Operative Surgery. During this period their *clinical training* consists of a six months' course in the medical wards, and another similar course in the surgical wards, of a recognised hospital, with clinical lectures on these subjects, a three months' course at the Ophthalmic hospital, a three months' course in a Maternity hospital, and they must be certified to be competent to attend cases of labour and to perform vaccination. They must also attend *post-mortem* examinations and take notes of them at the time.

---

* The following candidates shall not be required to pass the Preliminary Scientific examination or to devote more than four years to their professional studies after having taken their B.A. degree: (*a*) Bachelors of Arts previous to 1886, who have taken Physical Science for their optional subject; (*b*) Bachelors of Arts of 1886–87 and subsequently, who have taken either Physical Science or Natural Science for their optional subject. Of the latter, however, those who have taken Physical Science must pass the examination in Botany, and those who have taken Natural Science the examinations in Chemistry and Physics as laid down for the Preliminary Scientific examination, before appearing for the First M.B. & C.M. examination. (*Bye-laws of the University of Madras.*)

The *clinical training* for the students studying for the L.M.S. examinations of the University, the examinations for the Apothecaries' Certificates, and casual students studying in the Medical College, is the same as that for the M.B. and C.M. students, though their courses of professional study differ. The L.M.S. students who must have passed the F.A. examination, have no preliminary scientific training to pass, but have to work at Chemistry and Practical Chemistry during their first year of professional study. They have no training in Comparative Anatomy or Organic Chemistry, their course of study, therefore, is only four years instead of five. This degree was made by the University to take the place of the Apothecaries' Certificate of the College. The professional training for the students of the Apothecary Department of the College is the same as that for the L.M.S. students. Every student should make himself fully acquainted with the rules laid down in the College Calendar regarding his courses of study.*

Hints to students during their different periods of study.—The total period of clinical study is far too short to learn the *art* of the profession: a medical man's whole life is spent in adding to or forgetting what he learnt as a student. It thus behoves a student to see that his work is learned on *scientific* lines, and that he makes the best of the few months at his disposal. Only twenty months in his first two years in which to lay the scientific foundation of his profession by the study of Anatomy, Physiology and Chemistry; and only twenty months more when he has to learn the *art* of applying the knowledge he is gaining in Medicine, Surgery and Midwifery!

During the earlier period of his study the student should become used to seeing and understanding the wants of sick people. He should learn in the out-patient department and in the surgical wards how to dress wounds and ulcers, and how to bandage neatly and well. He should make himself acquainted with the names and composition of all the surgical dressings and the uses of the surgical instruments in common employment, especially those contained in the pocket-case. At this period, also, he should commence to train his senses of touch, sight and hearing ; he should never lose an opportunity of feeling a tumour, or of seeking for the sensation of fluctuation, or of handling a fractured or dislocated limb. He should educate his hand, his eyes, his ears on every possible occasion and in every possible way. He should train his eye to know at once the normal appearance of the human body and he should learn carefully all the anatomical land marks ; he should use every opportunity of training his ear to the use of the stethoscope from the day he commences the profession, by studying the normal sounds in healthy subjects and by getting the more senior students to correct his observations. He should gradually make himself acquainted with the names and composition of all the diets and of all the medicinal formulæ which are used in the hospital, so that when he commences the more important duties of *case-taking*, in his next period of study, he will understand the principles on which diets and drugs are ordered.

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* For information regarding the Revised Bye-laws see Appendix A.

This is the period a student should decide, for himself, if possible, whether he ought to continue the study of the profession ; whether he has that fitness or liking for the medical art which alone will make the peculiar labour of the profession, at the least, not distasteful to him ; whether nature has endowed him with the unselfish sympathy for the suffering which will enable him to give up his own pleasure for the benefit of the sick. If he has not got these qualities, he ought to give up the study of medicine and take to some other calling in life for which he is more fitted and in which the scientific training he has already gone through may be of use to him.

The first impression of a clinical student in hospital is that his task is an impossible one. Dr. Latham, in his valuable Clinical Lectures, thus describes his feelings :—" The scene bewildered me and I learnt nothing for months. It was something, however, to become reconciled to the objects around me and to look with complacency on what was going on : all I saw was ' a great multitude of impotent folk ' and the physicians busy amongst them with the expedients of their art. And some were recovering and some dying, some getting better and some worse, and some remaining unalterably the same. The physicians and their art confronted the patients and their disease and exercised, I plainly perceived, a great power on the whole."

Case-taking.—In the third year of *clinical study*, students commence the important duty of *case-taking*. Before doing so they should make themselves as far as possible acquainted with the chapters in this book bearing on the clincial examination of patients , particularly those on disease, on case-taking, and on the special modes of investigation. These chapters will be further explained to them by their clinical teachers.

Latham, in his work already referred to, gives the following advice : " Accustom yourselves to feel the pulse ; the number of beats is easily measured, but it has qualities which are referable only to the sensation of him who feels it, and you must educate your touch to the discrimination of them, for these qualities, much more than its mere number, serve to guide us in the detection of disease and the methods of treating it. The tongue, too, must be often looked at before you will be able to detect at once the marks which are morbid. There are certain secretions also, the different morbid qualities of which you must learn by frequent examination ; the expectoration, the urine, both have qualities upon which may depend the diagnosis of diseases and the choice of remedies. These are a few cardinal points with which habit must render you familiar and enable you to appreciate the information they are calculated to convey, before you can take cases for yourselves with any prospect of advantage."

" Let me also mention the Physiognomy of disease. This can never be adequately described, and I urge you always to remark it, and to dwell much on it, for some acute observers have drawn such secrets from the expression of the countenance, that it has been to them in the place of almost all other symptoms."

The student is required to arrive in the hospital at 6–45 a.m. and to find out at once whether any of the new admissions have been placed under his charge. He then takes the new case and makes notes on the others already under his care. The new case has to be read out, as soon as is convenient, to the visiting Medical Officer who corrects any errors, finds out from the student what he considers the case to be, what would be his treatment and what will be the probable result. These points the student should have settled in his own mind before-hand, and be able to give his reasons. The case should then be copied on the case-sheets specially provided for the purpose, and full records of diet and treatment, with accompanying notes, made as directed in chapters II and III.

he habits students acquire of observing disease, like other habits, tend to stick to them through life, and if they acquire accuracy of observation it will be invaluable. The first thing they have to do is to gain the confidence of their patient; this can only be done by calmness, delicacy, sympathy, patience and kindness. The patient is often stupid, timid, embarrassed or deaf, and the state of his health may interfere with his giving clear answers to questions. In Southern India, the natives are particularly nervous, and often make false assertions with regard to the duration of their illnesses on account of the mistaken belief they have that, if their disease is chronic, nothing will be done for them. These difficulties can only be got over by gaining their confidence.

Before asking any questions the student should observe the expression and whether the complexion is florid, pale or dusky: in dark persons the tint of the skin changes and the latter loses its glossy appearance. Note the general bulk of the body, whether well nourished, or wasted; whether there are any local swellings, atrophies or eruptions; note the power of locomotion and the free use, or otherwise, of the limbs. The student should also form his first impressions of the patient's vital powers, mental characteristics and peculiarities—all of which he will in time learn to do almost at a glance—and then he will be able to proceed to the study of the case in detail according to the rules laid down further on.

It is his duty to *exercise great patience* in listening to the often rambling statements of the patient, and in every case to *examine him thoroughly*. It takes long and careful practice before a student can record a case so that it constitutes a real 'word-painting'— such that any physician reading it would be able to say at once what was the nature of the disease. One fault, too frequently apparent in the cases recorded at the General Hospital, is a result of the habit into which so many students fall of recording their cases in a routine manner, whereby numbers of the cases appear almost identical when re-read. It is not so in reality, for every case of disease differs from others as much as the sufferers themselves differ, and the student should acquire the habit of investing each case with an individuality of its own. Lord Bacon, in advocating the writing of narratives of cases, which he points out is as old as the time of Hippocrates, says, "Nor get to exclude all but prodigies, and wonders, as several have done, for many things are new in their manner and circumstances, which are not new in their kind; and he who looks attentively will find many particulars worthy of observation in what seems vulgar."

Text-books.*—Latham says, when writing of books for students to read, "They only who are practically informed can read good books with profit, or bad books without injury."

The different text-books required in the College are very valuable, but students must remember that they do not describe disease as it exists in *every* case: they have been happily compared to 'maps' of a country, and used as such they will be useful. A good plan is to study the case as it is when corrected by the clinical teacher and at the same time to read up the subject in the text-book: when the student meets with any difficulties, he should not fear to ask his teacher. Much may be learnt also by conversation on such subjects with other students who have already studied them. If the student records his cases carefully and conscientiously, he will have acquired a habit which will be of the greatest use to him in after life, and which will do much to prevent his degenerating into that most abhorrent of beings—a routine practitioner.

Microscope.—It is absolutely essential for every medical student to learn the use of the microscope. There is no difficulty about it, and the chapter on its use will make it clear that all it requires is a little time and patience to enable him to manipulate it properly. He will then find it an invaluable aid to accurate clinical work.

Post-mortems.—A few words on the duties of the *post-mortem* clerks. If students neglect their opportunities in this line they may never again have the chance of seeing *post-mortems* demonstrated, or of acquiring the necessary dexterity and system. In every case in which it is possible, students should endeavour to confirm the accuracy of the diagnosis, and of their observations of the physical signs during life. It is in the *post-mortem* room they often learn modesty with reference to their powers of diagnosis. Every case they examine will teach them something new of the variations found in diseased structures. It is a necessary preparation for the medico-legal examinations which every medical man in this country may be called upon to make. The *post-mortem* room is also an admirable place in which to acquire dexterity in passing catheters, in drawing teeth, and in handling the knife generally.

---

* Students who desire to study a work exclusively devoted to clinical medicine are strongly advised to obtain one of the three following manuals, as being thoroughly up to date and moderate in size and price: *Medical Diagnosis*, by Dr. Graham Browne; *Physical Diagnosis*, by Drs. Gibson and Russell; or *Clinical Manual*, by Dr. Finlayson.

There are a few hints I would like to record for the information of students. Brigade-Surgeon Gray, for long years a clinical teacher in, and afterwards Principal of the Grant Medical College in Bombay, when speaking to the students there in 1889, said, amongst other things, "The main hinderance we encounter when new students are taken in hand is the deficiency of their knowledge in English, in which language they are taught, and in which the medical literature they study is written." Will not our students try to correct this fault by hard work, making up for any deficiency they may have started with? Again he says, "Another source of difficulty lies in certain personal defects which characterise our students. I shall not say a single word on this topic, which I have not already said on many occasions to my class. The first fault is a most defective sense of duty and responsibility. It is too often the case that if a student is deputed to perform any act, he either neglects it or delegates the work to some one else, with the frequent result that it is not done at all. He is either lazy or, sometimes, I fear, he regards the duty as menial, and will not condescend to do it; but whatever the immediate cause, there can be little doubt that the defective sense of duty I complain of is at the bottom of the trouble. The natural consequence is that students are not trusted, as they should be, to their manifest injury. Additional faults with which we have to deal are want of method, desultory manner of working, and a tendency to depend on others instead of doing things for themselves." He goes on to speak of some of the better qualities of our students, their great industry and application, their amenability to discipline and their obedience. I am sure it is only necessary to point out those faults, which characterise our students in Madras as well as those of Bombay, to encourage some of them, at least, to get rid of them, and to enable them to adopt a high standard of duty for themselves. They should always remember that in the practice of their profession they are dealing with the life or health of a fellow human being who trusts himself to their care, in confidence, believing that they will apply all the art and knowledge they possess to the alleviation of his sufferings, and they should always be guided by the idea so beautifully put by Longfellow :—

In the elder days of art,
Builders wrought with the greatest care
Each minute and unseen part ;
For the gods see everywhere.

In conclusion, all your scientific training, all your acquired knowledge of anatomy, physiology, pathology, chemistry and all other branches of your profession will, as pointed out by Dr. Brown in his delightful ‘Horæ Subsecivæ,’ be useless without *sense* and *genius*. Sense, as he says, drives or ought to drive the coach ; sense regulates, combines, restrains, commands all the rest, even the *genius*—and sense implies exactness and soundness, power and promptitude, of mind. *Genius* is a real turn for the profession, a peculiar natural aptitude or tendency to any one calling or pursuit over all others, but it is not enough without *sense*.

The Medical profession requires *more than the average* intellect, energy, attention, patience and courage, and more of that singular but imperial quality, at once a gift and acquirement, *presence of mind*, than almost any other department of human thought and action, except perhaps that of ruling men. Hence the importance of getting rid of men wanting in intelligence early in their study of medicine, as they are useless, no matter what examinations they pass, whilst they may make excellently useful men at other callings.

CHAPTER II.

CLINICAL EXAMINATION AND NOTE-TAKING OF MEDICAL CASES.

The following scheme for case-taking is that adopted in the medical wards of the General Hospital in accordance with modern clinical methods. The student makes use of it in the form of a ‘case-card’ with which he is furnished to enable him to take cases at the bed side. If intelligently used, such a scheme is of the greatest value to all concerned, but if used ignorantly or as a means for routine case recording, it becomes, if anything, a positive hindrance to the user. Too often, students attempt the work of case-taking without commensurate knowledge and without collateral observation and reading, the result being the production of formal records, practically valueless as clinical histories, painful to listen to when read and entirely uninstructive to the other students. The student should study this scheme with the greatest care ere commencing the work of case-taking in the wards. He will find it a very useful scaffolding, by the help of which he can erect the structure which is to form the permanent record. Used aright, the result will be a verbal edifice of excellent proportions and design, and free from all suggestion of the primary frame-work: used carelessly, the result will be a mass of verbiage, indistinct in form and obviously dependent on the original scaffolding for any cohesion it may possess:—

Ward. *No.*

1. Name. 2. Age. 3. Occupation.
4. Place of Birth. 5. Place of Residence.
6. Date of Admission. 7. Date of Examination.
8. Complaint. 9. Duration of Illness.

[Insert Thermometer.]

HISTORY.—Hereditary Tendencies—Habits as to Food and Drink—General surroundings at Home and at Work—Previous Illnesses and Accidents — Time and Mode of Origin and Course of present Illness.

STATE ON ADMISSION—

General Facts.—Condition as to Height and Weight—Development—Muscularity—Obvious Morbid Appearances, as Jaundice, Dropsy, Cyanosis—Evidences of Injury or Previous Disease — General Appearance and Expression of Face—Temperament (if well marked) — Attitude (if unusual) —Temperature.

ALIMENTARY SYSTEM.—Lips — Teeth — Gums—Tongue Secretions of Mouth—Fauces—Deglutition—Appetite—Thirst—Sensations during Fasting—Sensations during and after Eating (Comfort or Discomfort — Pain — Weight—Distension—Heartburn—Nausea) — Acidity — Flatulence — Eructation — Waterbrash — Vomiting (Characters, Macroscopic and Microscopic, of Vomited Matters)—State of Bowels and Character of Fæces. Abdomen — Inspection (Prominence — Retraction — Distension —Flaccidity) — Palpation (of parietes—of Contents, normal or abnormal—Tenderness—Fulness —Fluctuation)—Percussion (Vertical Dulness in Right Mammillary line, and, if necessary, outline of Liver, &c.).

HÆMOPOIETIC SYSTEM.—Lymphatic Vessels and Glands —Ductless Glands (Spleen—Thyroid— [Microscopic Characters of Blood (Corpuscle Counting and Determination of Hæmoglobin if necessary)].

CIRCULATORY SYSTEM.—Subjective Phenomena (Pain—Palpitation—Faintness—Dyspnœa)—Inspection (Form and Appearance of Praecordia)—Palpation (Position and Character of Cardiac Impulse)—Percussion (Superficial and Deep, Outline if necessary)—Auscultation (Rhythm and Quality of Sounds in Mitral, Tricuspid, Aortic and Pulmonary Areas and over General Surface of Heart and Main Vessels)—Pulse (Frequency—Rhythm—Character)—Arteries, Capillaries and Veins.

RESPIRATORY SYSTEM.—Breathing (Frequency—Rhythm—Type—Painfulness)—Cough—Sputum (Macroscopic and Microscopic Characters)—Nares—Pharynx—Larynx (Voice—Pain—Tenderness)—[Laryngoscopic examination if necessary]—Inspection (Form and Action of Thorax, Measurement if necessary)—Palpation (Vocal fremitus)—Percussion (Anterior and Posterior at *corresponding points* on the two sides of Chest)—Auscultation (Determination at each point during Natural and Deep Respiration, of the Duration of Respiratory Sounds, their Quality or Character, Accompaniments or Superadded Sounds, and of the Vocal Resonance).

INTEGUMENTARY SYSTEM.—Subjective Phenomena—Skin (Dryness—Moisture)—Obesity—Emaciation—Œdema—Emphysema—Eruptions (Distribution—Elements of Skin involved—Type—Cause).

URINARY SYSTEM.—Subjective Phenomena (Pain or Uneasiness in Loins, Bladder or Urethra)—Micturition (frequency).

Urine.—Quantity—Color—Specific Gravity—Chemical Reaction (*Acidity—Alkalinity*) Albumen—Sugar—Bile—Deposits (Macroscopic and Microscopic Characters).

REPRODUCTIVE SYSTEM.—MALE (Subjective Phenomena—Functions—Testicle—Epididymis—Prostate—Urethra). FEMALE—Subjective Phenomena—Catamenia—Abnormal Discharges—Vagina—Uterus (Examination, Digital, with Speculum, etc., if necessary)—Ovaries.

NERVOUS SYSTEM—

Sensory Functions.—Sensations (Pain—Heat—Cold—Formication—Numbness—Tingling)—Sensibility to Touch—Heat—Tickling—Pain—Muscular Sense—Sight [Ophthalmoscopic Examination if necessary]—Condition of Pupil—Hearing [Otoscopic Examination if necessary]—Taste—Smell.

Motor Functions.—Organic Reflex (Swallowing—Breathing—Micturition—Defæcation, &c.)—Skin Reflex—Tendon Reflex—[Voluntary (Systematic Examination of Groups of Muscles if necessary)]. [Co-ordinating]—[Electric Irritability (Faradic, Galvanic)].

Vaso-Motor and Nutritive Functions.—Local Congestions—Pallor—Œdema—Inflammation—Sloughing—Wasting—Perspiration, &c.

Cerebral and Mental Functions.—Intelligence (Hallucinations—Illusions—Delusions—Torpor—Coma)—Attention—Memory—Speech (Comprehension of Language, heard, seen; Utterance of Language, spoken, written)—Sleep.

Cranium.—(Peculiarities)—SPINE (Form and Appearance—Percussion—Hot Sponge Test).

LOCOMOTORY SYSTEM.—Bones — Joints (Pain — Swelling—Effusion—Mobility)—Muscles (Rigidity — Flaccidity — Cramp—Twitching, general or fibrillary—Hypertrophy—Atrophy).

PROVISIONAL DIAGNOSIS.

PROGNOSIS.

TREATMENT.—General Directions—Dietetic—Medicinal.

FURTHER REPORTS.

In Acute Cases *report Daily*, or more frequently if necessary.

In Chronic Cases report Once or Twice a week, always noting any change of Diagnosis or Treatment.

At Conclusion of Case, note the result (Died—Cured—Relieved—Discharged otherwise), and the result of Post-mortem examination (if held).

[Sign]

To consider in any detail the various portions of such a scheme would require a large volume of itself. The student will find, however, that many of the chapters in this book are devoted to the study of clinical methods and the examination of special systems and organs, the various excretions, &c., in health and in disease, and he should at once proceed to read these chapters most carefully, taking every opportunity to verify the facts therein stated and to *practise the methods of investigation*, such as inspection, percussion, &c., on himself and on any other available healthy subjects. Before he can with profit study or record the abnormal he must be thoroughly familiar with the normal.

Certain points in case-taking, however, require special emphasis in order that the objects of such a scheme may be made clear and the value of the latter realised. The order of the headings as far as the end of the second paragraph must be rigidly observed. Thereafter it is generally most convenient to take up first the system which is obviously the seat of disease, *e.g.*, in dysentery or peritonitis the alimentary system, in asthma the respiratory system, in heart-disease the circulatory system, and so on. Again, where a particular system appears, after examination, to be quite normal, it is sufficient to say so, provided that the student has conducted the examination of the system conscientiously and thoroughly; but under the circulatory system the pulse should always be described as to frequency, rhythm and character, and under the urinary system the result of the examination of the urine must be given. With regard to the diseased system or systems, it is not sufficient to imply that any organ or function is normal by omitting all reference to it; it is absolutely necessary in every case to mention the result—positive or negative—of examination. For example, in all cases of abdominal disease the results of inspection, palpation, &c., of the abdomen must be given clearly, the upper and lower limits of the hepatic dulness mentioned, the frequency and nature of the motions described, &c. In the same way, in a case of heart-disease, it is not sufficient to omit reference to the apex beat if its position appears to the student to be normal: the results of inspection and palpation must be precisely recorded.

Although, as stated above, the order in which the systems are examined and noted may with advantage vary in different cases, *the order of the headings under each system must be carefully adhered to*, both during the actual examination of the patient and in the case record. There are special circumstances in which it may be difficult or inadvisable for the practitioner to do so, but with these the student has no direct concern. He that fails to cultivate the habit of exact and methodical examination of patients will surely add yet one more unit to the ranks of the haphazard doctors who are but little better than quacks masquerading in the guise of competent licensed practitioners.

In commencing the record of a case the student should sit down quietly beside the patient, without too much show of business, and try to obtain his (or her) confidence. To an ignorant person he should say in a kindly manner "I want you to answer all my questions as carefully as you can. I will then tell the doctor your answers, so that he may know all about you and cure you as quickly as possible. But be sure and tell me the truth only."

Get the *name*, *age*, &c., as accurately as possible. If, as commonly occurs in India, the patient does not know his age and merely makes a guess at it, put 'supposed age' instead of 'age.' Under *occupation* do not be content with 'cooly,' but ascertain the exact nature of the work, such as cigar-roller, chunam carrier, picottah man, &c. Under *place of birth* and *place of residence* give sufficient details as to the places in which, and for how long in each, the patient has resided during his life. *E.g.*:—*Birthplace*—Calicut. *Place of residence*—Left Calicut when ten years old; Permaad (for about twenty years); Madras (for the last six months).

Complaint.—By this is meant the symptoms—subjective and objective—of which the patient himself complains, *e.g.*, 'fever, pain in the chest and cough;' *not* the name of the disease. Great care must be taken to note these symptoms, but no leading questions must be asked.

Duration of Illness.—This refers to the *present* illness, whether it is the first occasion on which the patient has so suffered or whether it is merely a fresh attack or recrudescence of a former disease, *e.g.*, syphilis or rheumatism.

Under the general heading of HISTORY is included what have been respectively called the *family history* (hereditary tendencies), the *social history* (habits as to food and drink—general surroundings at home and at work—&c., &c.,) and the *history of the present illness* (time and mode of origin and course of present illness). It is obvious that there is great scope for useful enquiry in these relations, and many an apparently puzzling case has resolved itself into a very simple one as a result of careful cross-examination of the patient. It is no exaggeration to say that one person will fail to elicit any point of importance, whilst another, in recording the same case, will make the cause and progress of the illness up to date abundantly clear. On the other hand, let the student remember that what is required is something very different from the Police Court style of cross-examination. Tact and courtesy, and a kindly consideration for the feelings of the patient, will succeed where 'badgering' and a pseudo-legal manner will fail.

Hereditary tendencies.—Few diseases are directly inherited. Of those that are, the following are the more noteworthy—syphilis, hæmophilia and nervous diseases, *e.g.*, pseudo-hypertrophic paralysis, epilepsy, chorea, progressive muscular atrophy and certain forms of insanity. In the case of other so-called 'hereditary' diseases it appears, rather, to be a peculiar *tissue-predisposition* which is inherited, by virtue of which the subject is very liable to become infected on exposure to the specific poison under favouring conditions.

Examples of such diseases are tuberculosis (and scrofula), cancer, gout, rheumatism, &c. In this connection it is important to remember that fundamental affections of different kinds have very varying modes of expression. For example, the so-called rheumatic diathesis may show itself in joint affections, in heart-disease, in chorea, in psoriasis, or possibly in renal concretions or attacks of emphysematous bronchitis.* The varied manifestations of syphilis are endless; so, also, of gout. Finally, it must be remembered that disease may skip a generation and then re-appear (atavism).

To secure accurate information on the above points is no easy matter, except with very intelligent patients, and it is evident that the favourite students' formula "Patient gives (*sic*) no history of hereditary tendencies" is merely a cloak for laziness on the part of the student, who is too indolent to try and overcome the stupidity or wilful *suppressio veri* on the part of the patient. The practical value of such information, when carefully gleaned, is great; more especially in the case of a family well known to the medical adviser. "The family physician, who comes in contact with one or more generations, profits most by the knowledge of the family history. He learns the predisposition to various minor ailments—to headaches and attacks of indigestion, 'bilious attacks' for instance; he learns the power of resistance in the family to disease, of its capability to undertake large duties in life; he learns of their susceptibility to drugs, and the tendency in them to take stimulants. Nerve force is the capital with which the battle of life is kept up. If it is at a minimum in groups of families, diseases or conditions of poor health due to its use, a use not excessive in others, arise."†

Social history.—Under the term social history is included anything and everything in the life history of the patient that in any degree bears upon the present illness. Here again the greater the knowledge and tact possessed by a student the better will be this part of his case records. It is impossible to do more than suggest the principal lines of enquiry for general ward work: it is for the student to notice any point of importance gleaned from the patients' answers and to follow the trail thus given with unfailing persistency, however obscured it may be by irrelevant statements and seeming contradictions. In by far the majority of cases something of importance is discoverable if trouble be taken.

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* Finlayson.

† Musser.

Habits as to food and drink.—In the diseases of childhood errors in dieting hold a front place in etiology; hence, in all such cases, it is imperative to ascertain as much as possible on this important point from the mother or other person. In the case of adults, also, a large number of diseases are caused or made worse by mal-dieting. As to character of food there may be error in any of three directions, viz., errors of excess, errors of deficiency and errors of quality, and these may be combined. Again, there may be error in point of time or regularity of meals and, lastly, there may be error in the manner of eating. Examples of such mistakes are constantly seen. The greater number of native patients who come to the medical wards of the General Hospital, with the exception of those in Government service, are found to be suffering from mal-nutrition consequent on defective dietary, and 'feeding-up' is what they require as an essential part of treatment. A few, and especially those from the West Coast, are suffering from excess, their dietary being very rich; whilst yet others are victims to irregularity of meals or to eating too much at one time and too little at another, or to eating too quickly and without sufficient mastication. In regard to inquiries about drinking habits it is to be noted that we have here to deal with a point on which the patient frequently prefers silence to the giving of information. When questioning the ordinary cooly or ryot, in Southern India at all events, much the better plan is to ask him quietly and quite casually. "*How much* liquor do you drink daily?" and not "Do you drink?" It is nearly always a question of means with them. If they can afford it they drink daily; otherwise whenever they can. A little gentle persistence will generally elicit the truth, particularly if they are informed that it is nothing to you, personally, how much they drink: you only wish to know in order that they may get the proper treatment. Under the same heading come all other stimulants or narcotics, such as opium, Indian hemp in its various preparations, coffee, tobacco, &c. A case of indigestion, cardiac palpitation, nervous exhaustion or other illness may be very puzzling if the above habits have not been carefully inquired into. When there is any doubt as to the truth having been elicited the student should write "He *says* he does not drink," and so on, not "He does not drink."

General surroundings at home and at work.—In this particular, also, no two persons are similarly situated, yet the student is generally content with "General surroundings at home and at work, bad" or "Fairly healthy," as the case may be. The whole question of occupation, about which alone many volumes have been written, comes up for consideration and enquiry. Every system and portion of the body may be injured by unfavourable occupation; the lungs through playing on wind instruments or through constant exposure to a deleterious atmosphere; the kidneys and liver through unavoidable chill or through ease of obtaining alcoholic liquors, as in distillery workers; the skin through irritation, as in dye works; the nervous system, through the noise of machinery or through working under increased pressure, as in diving; the circulatory system through excessive strain; the locomotory system through constant exposure to damp and wind, &c., &c. Some men never walk more than a few yards a day, such as clerks; others are constantly in the saddle or walking long distances, such as cavalry soldiers or postmen. And, just as surroundings at work vary so do surroundings at home, though not, perhaps, to the same degree. The man who lives in a crowded bazaar or a filthy parcherri (bustee), lives under conditions more constantly prejudicial than the ordinary ryot. So, also, residence in a particular part of a large town or in a very malarious district may play an important part in inducing disease or retarding convalescence. The sleeping place, the habits as to bathing, the question of overcrowding and many other correlated matters, should all be carefully gone into with a relative fulness according to the nature of the case.

Previous illnesses and accidents.—The student should take great trouble to elicit all available information under this head. The ordinary native patient has little, if any, idea of possible connection between his present disease and former illnesses. He generally, therefore, assures his questioner that he has been always quite healthy up to his present attack. This, of course, is but rarely a truthful statement, though many persons who have passed their lives in healthy and isolated districts in India do escape the measles, mumps and other infectious diseases of childhood so common in more crowded localities. But nearly all have had malarial fever, gonorrhœa, dysentery, &c., and many have had small-pox, rheumatism (acute or sub-acute), pneumonia, asthma, anæmia (generally due to anchylostomata) or syphilis. Certain diseases, such as rheumatism, syphilis, malarial poisoning, sunstroke, &c., are very apt to permanently injure a person's health on account of the *sequelæ* or after-effects] which may ensue, and the knowledge that the patient has formerly suffered from some such disease is very important in order for correct diagnosis, prognosis and treatment. In the same way, the history of previous accidents and surgical operations must be carefully ascertained and noted. If, in a case of epilepsy, the evidence under 'hereditary tendencies' is clearly negative, whilst a definite account of head injury some years previously is obtained, the case assumes a very different aspect as regards prognosis and treatment to one occurring under the reverse conditions or consequent upon syphilitic infection. The student, therefore, who cannot possibly discount the value or bearing of former disease so well as the experienced physician, should make his enquiry as full and conscientious as he can and may reasonably look for help from his teacher in following up any indication of importance.

Time and mode of origin and course of present illness.—The patient should, as far as possible, be allowed first of all to tell the story of his illness in his own words. With some, this means that the student has to listen to a painfully long and tedious 'rigmarole' involving frequent repetitions and contradictions. With others, who are unable or are unwilling to take trouble, it means either that very little information can be gleaned in this way or else that what is said is intentionally or unintentionally misleading. In every case the value of the statements made has to be estimated by the medical officer, but the student, by using his power of observation, may render very material help. Having learned what the patient has to tell in his own words, the student must carefully go over the same ground, doing his best to secure an accurate account of the *sequence* or chronological order of events. This is by no means easy and, indeed, is sometimes impossible in the case of stupid patients, but it is very important and the student must patiently do his best, asking the same question, if need be, in many different forms. One of the most practically useful ways for ascertaining the date of the commencement of an illness is, not to depend on the stated onset of any particular symptom, but, instead, to ask plainly "How long is it since you were quite well"? or, "How long is it since you stopped working"? as may best suit a given case.

"Did the swelling of the feet precede or follow the diminution in the amount of urine"? "Where did the swelling of the body first appear"? "Did you vomit the blood before or after you noticed the tumour in your side"? "Was it the cough or fever which came first"? These and similar enquiries must be pursued till satisfactory answers are obtained, remembering that an ignorant person will generally be able to tell more about the appearance in point of time of objective symptoms (or signs) than of subjective symptoms. "To suppress the loquacious, free the tongue of the silent, gather scintillations of intelligence out of the dense clouds of ignorance, requires knowledge of human nature of a high degree, acquired only by long practice." * Lastly, a special word of warning is necessary regarding the unhesitating acceptance of statements made by two classes of patients, viz., those suffering from venereal disease and those in Government service who come to hospital with a view to shirking duty, obtaining leave or applying for pension. In such cases an ounce of direct observation is worth many pounds of volunteered information.

So far the information gained has been chiefly subjective and the student has been dependent upon the statements of the patient. He now commences the objective examination by carefully noting his general condition.

Height and weight.—These are both of value and should always be ascertained where possible, *i.e.*, when the patient can walk or be carried without injury to the measuring machine. The height is of importance because of the ratio that normally exists between weight and height. In disease this may be much altered. The weight is of corresponding importance, but has an additional value of its own inasmuch as gain or loss in this direction is one of the most certain means of estimating improvement or the reverse in a large number of diseases. Particularly is this the case in pulmonary tuberculosis and diseases of the alimentary tract. In the latter class of diseases, in which the sick person is frequently placed on a very simple fluid diet, there is almost sure to be some diminution at first owing to the sudden change in his dietary; but this is more than compensated for by steady subsequent gain. In a few cases, where sources of error are excluded, rapid differences of weight are recorded, *i.e.*, the person gains several pounds one week and loses them the next, but such cases are certainly rare. The weighing machine should be regularly tested by a competent individual and students should see that the conditions of weighing as to time, clothing, &c., are identical for each weighing. The best plan is to fix a certain time on a certain day, say, between 7 and 8 A.M. on Mondays, for weighing the patients in one's charge.*

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* Musser.

Development and muscularity.—Both in development and in muscularity the average patient in Southern India is considerably below the European (or rather British) standard. A very large number are improperly nourished and even where they are well nourished it is more in the direction of

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* I am not aware of any accurate table giving the results of investigation in India into the normal relation between height and weight. In the case of Hindus it seems almost certain that, in Southern India at all events, they will prove to be lighter for a given height than Europeans. The following table has been compiled from the returns of different jails, &c., as indicated below. The weights must be regarded as only approximately accurate, but it will serve as a rough guide. The marked excess of weight for height of Englishmen, as compared with the average Indian, is very noticeable :—

Number.	Average height in feet and inches.	Average weight in pounds.			Average difference between Indians and Englishmen in pounds.
		Madras Penitentiary.	India.	England.	
1	4·11	87	90	...	...
2	5·0	88·5	95	...	...
3	5·1	94·5	98	120	22
4	5·2	96	100	126	26
5	5·3	101·5	104	133	29
6	5·4	103·5	106·5	139	32·5
7	5·5	106	109·5	142	32·5
8	5·6	111	113	145	32
9	5·7	112·5	116·5	148	31·5
10	5·8	121	121	155	34
11	5·9	123·5	125	...	...
12	5·10	126·5	129	169	40
13	5·11	137	136·5	...	...
14	6·0	147·5	147·5	178	30·5

No. 1.—Coimbatore Jail and Madras Penitentiary.

Nos. 2-7.—Bhagalpur and Buxar Jails, Bengal; Mill operatives, Bombay; Coimbatore Jail and Madras Penitentiary.

Nos. 8-12.—Bhagalpur and Buxar Jails; Coimbatore Jail and Madra Penitentiary.

No. 13.—Bhagalpur Jail and Madras Penitentiary.

No. 14.—Madras Penitentiary; average of 3 units only.

adiposity than muscularity as a rule. Exceptions are seen in the case of sepoys and policemen, both of which classes, however, consist of picked men and have, moreover, undergone gymnastic training and drill. Patients from the Malabar Coast are, on the whole, much better formed and nourished than those from other parts of Southern India. Again, there is a difference between Telugus and Tamils, the former being usually more gracefully made and, in appearance, more muscular. This is, however, somewhat misleading, for the semistarved and even misshapen Tamil generally proves himself to be made of 'sterner stuff' and to be more resistant to the inroads of disease than the Telugu, as those who have had to deal with different classes of sepoys well know. But the student should remember that what is chiefly desired in medical records, as opposed to anthropometric work, is the ascertaining of how far the patient has departed through sickness from his own original condition and appearance when in health, and not his degree of conformity to a certain standard. The latter point belongs rather to the examination of individual systems, *e.g.*, the shape of the thorax, under the respiratory system.

Obvious Morbid Appearances.—Under this heading is to be noted any specially obvious abnormal condition of the skin, sub-cutaneous tissue or mucous membranes generally. Examples of such are profuse perspiration (hyperidrosis) extreme pallor—seen best where the skin is delicate and vascular, as in the ears, lips, &c.,—redness, cyanosis, jaundice, bronzing, &c., of the skin; œdema, adiposity or emphysema of the sub-cutaneous tissues; pallor or icteric tinging of the mucous membranes. The special signification of such appearances can only be appreciated when the student has studied systematic medicine.

Evidences of Injury or Previous Disease.—The greater number of diseases leave no external trace upon the person, but some, and notably small-pox, are very apt to induce more or less permanent marking of the skin, blindness, deafness or other defect. So, also, syphilis may induce scarring, induration, perforation and other permanent lesions of bodily structures, whilst paralysis, rickets, scrofula and injuries of various kinds may lead to interference with the use of one or more limbs, to deformities, extensive cicatrisation, &c.

Under this heading may also be noticed the various so-called *cachexiæ*, in each of which there is a profound condition of general ill-health due to the ravages of certain diseases, especially those which result in a diminution of the number of red blood corpuscles or in lessening of the amount of hæmoglobin. The commonest, and therefore most important, in this country is malarial cachexia. Others are the scorbutic, syphilitic and cancerous. Space will not permit of a description of them, but the student should accustom himself to noting the peculiar appearances presented by each form as opportunity offers. In some cases, the appearance of a person suffering from long continued hepatic suppuration or from chronic dysentery closely resembles that due to cancer and caution must therefore be exercised in relying on this point for diagnosis.

General Appearance and Expression of Face.—The acute observer will often derive most valuable information from his first glance at the patient. For example, he may be able to assure himself, in spite of voluble assurance to the contrary, that the patient is addicted to the abuse of alcohol, opium, Indian hemp or other drug, that he is evidently a debauchee, or that there are signs of incipient insanity, and so on. Not only so, but he may have his attention forcibly directed to the diseased system by noticing a violent action of the alæ nasi, rigidity or tonic spasm of certain muscles, obvious enlargement of the abdomen, the legs drawn up to relax the abdominal muscles, the hands grasping the bed to aid the extra muscles of respiration, and many other important signs.

Of especial value are the appearances frequently presented by the face, which constitute the different so-called *Facies*. Here again, direct observation is worth much more than description, but the student should know the leading types. In the facies of the collapse stage of cholera, which is practically identical with the Hippocratic facies of impending death, the skin is pale or livid, the cheeks sunken, the eyeballs retracted and the eyelids half closed, the nose pinched and the lower jaw relaxed. In intestinal obstruction and acute peritonitis the face often wears a peculiarly 'anxious' expression and, when the pain is very severe, the upper lip may be retracted, showing the teeth. Students are very fond of recording the expression of the face as 'anxious' in ordinary cases of illness, but the term should be restricted to the characteristic appearance seen in such cases. A person in the typhoid condition (*not* confined to typhoid fever) has a dull, expressionless appearance; the lips are dry and cracked, the teeth coated with sordes. In facial paralysis, where the muscles of one side are usually paralysed, the appearance is naturally peculiar, particularly when the patient tries to wrinkle his brow, to shut his eyes, to whistle or to laugh. In the facies of hectic fever the cheeks are sunken and the region of the malar prominences is covered with a circumscribed flush. When seen in acute disease it is said by some to be 'diagnostic of pneumonia.' Where the skin is dark such flushing cannot be detected. Inspiratory dyspnœa, expiratory dyspnœa, failure of compensation in mitral disease, and many other conditions, affect the facies in more or less characteristic ways which should be carefully described by the student when he comes across them. Lastly, the face is sometimes an excellent index as to the nature or degree of pain. The hysterical or hypochondriacal subject will describe his sufferings as 'appalling' with a cheerful countenance; the schemer will contort his face whilst the physician's eye is upon him, only to resume a natural expression when he considers himself to be unwatched; but the real sufferer will often afford most valuable, though unwilling, information as to the extent or distribution of the pain. Considerable clinical experience, however, is necessary in order for the just appreciation of this symptom, and the observer must always take into consideration the other guides in this matter, such as the pulse, the temperature, the appetite, sleeplessness or the reverse, &c.

Temperament.—Certain forms of temperament or constitution have been described and great stress laid upon their diagnostic, or rather prognostic, value by some. The chief forms are the sanguine, the bilious, the nervous and the lymphatic, with intermediate forms, such as the nervo-sanguine. The matter is one of great interest and of corresponding difficulty. The student, *quâ* student, has enough to remember without seeking to burden his mind over this matter. Those who wish for further information must seek it in larger works. It is defined by Ord * as denoting the "correlation of grouped differences existing among men, in respect of physical structure and conformation, with differences of functional activity, of mental endowment and disposition, and of affection by external circumstances" and he rightly notes that many of these constituents are capable of being partly or completely changed by age, external circumstances, habit, disease and suffering, religious enthusiasm, moral contest or bodily indulgence,' &c.

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* Quain's *Dictionary of Medicine*, article 'Temperament.'

Attitude.—Primarily must be noticed the general difference in attitude which exists between the healthy and the sick, or, again, between those who are really sick, and those who are feigning disease. But there are certain positions adopted by persons in bed which are fairly characteristic of special conditions. These are included under the general term *decubitus*. Lateral decubitus is specially seen in cases of lung disease, the person lying, as a rule, on the *affected side* so as to give the other very free play. So, also, where there is effusion—pleuritic or pericardial—the same thing is done and for the same reason. If, however, the pain is superficial and extreme he may be obliged to assume the dorsal or even the prone position. In diaphragmatic pleurisy the position may be very characteristic, "the erect sitting posture, with the body leaning forward and laterally, to relieve the pain." * Dorsal decubitus is commonly seen in health, but is only assumed temporarily and easily as a change from the lateral position. In disease the most marked form is seen in patients in the typhoid condition.† Here the sufferer slips down in the bed, his face wears the peculiar appearance described above, and his hands twitch convulsively (*subsultus tendinum*) or pick the bed-clothes (*floccitatio*) whilst he tosses his body from side to side (*jactitatio*) occasionally. When, in addition to the dorsal position, the legs are flexed on the thighs and the thighs on the abdomen, there is strong suspicion of acute peritonitis, appendicitis or other abdominal inflammation. In intestinal or hepatic colic the position assumed is generally the lateral or dorsal, with the legs drawn up and the trunk curved downwards as much as possible. The upright (*orthopnœa*) or semi-upright decubitus is almost confined to conditions in which 'want of breath,' *i.e.*, dyspnœa or apnœa, is the most urgent symptom. Amongst such are asthma, emphysema and advanced chronic bronchitis, various forms of heart failure with embarrassed circulation, large pericardial or pleural effusions. In very bad cases the patient is quite unable to remain in bed and sits upright in a chair, with the head leaning forward or resting on a special support. *Opisthotonos* is the name given to a position almost pathognomonic of tetanus or strychnine poisoning where, owing to the tonic contraction of the muscles, the back is arched and the body rests on the head and heels. *Emprosthotonos* is a lateral modification of the above. Besides these fixed positions there are various others with no special names, seen especially in hysteria. The restlessness exhibited in certain diseases, such as chorea, cerebral meningitis, &c., can only be alluded to. Lastly, very numerous peculiarities of attitude and gait are noticed in different forms of nervous disease, but these are more properly described under the nevous system.

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* Musser.

† As also during labour in a woman.

Temperature.—The temperature of the patient should always be taken on admission. Any considerable degree of elevation above or depression below the normal (98·4° Fah.) denotes corresponding urgency for attention.*

Having got so far, the student should then begin the Systematic Examination of each system, perferably taking the diseased system first. In his examination he should *keep strictly to the order denoted on the case-card, e.g.*, under the respiratory system, he should not describe any adventitious sounds till he has completely recorded the duration and quality of the breath sounds; under the circulatory system, in describing the pulse, he should give (1) its rate, (2) its rhythm, and (3) its character, and *not* the character followed by the rate, omitting the rhythm altogether, as is too commonly the case, even amongst those who should know better. Never describe special regions as regards inspection, percussion, &c., but examine the entire system as regards each heading in its proper order. Thus, do not say "On the right side anteriorly the chest is deficient in movement and somewhat flattened: on percussion there is marked dulness" and so on, but, "On inspection," &c., finishing the description of the thorax in this respect before percussion is entered upon. Otherwise confusion and misunderstanding will certainly arise.

Provisional Diagnosis.—When the examination is complete, the student should usually possess some idea of the nature of the case. This he should state under the heading Provisional Diagnosis, and it should be the expression of his own independent opinion entirely uninfluenced by the diagnosis on the diet sheet at the bed side.

Prognosis.—So, also, the Prognosis, or probable result, 'immediate' or 'remote,' or both, should be honestly given.

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* *Vide* Chapter XI.

Treatment.—This is sub-divided into general, dietetic and medicinal, but the student is very apt to disregard the first two, though these are frequently of the greatest importance. By general treatment is meant anything not strictly dietetic or medicinal, *e.g.*, rest in bed, the wearing of a flannel binder, massage, &c. The proper dieting of the sick in medical wards is a matter requiring considerable knowledge and experience.* Many a patient is injured and the good effects of other treatment retarded, or undone, by injudicious dieting. On the other hand, many slight cases of diarrhœa, dyspepsia and other diseases may be completely cured by simple regulation of the diet. Medicinal treatment is divided into 'external' (or 'local' or 'topical') and 'internal,' but the distinction is sometimes ill-defined.

Reports.—These, like the original case record, may be made absolutely valueless or just the reverse, according to the trouble taken and the degree of intelligence shown by the student. Too often the notes merely consist of a dry record of the temperature, number of motions, pulse, &c.—facts which are (or should be) already noted on the chart. What is really required is that the student should report anything of importance *except* these things, particularly noting any change discovered on re-examination of the diseased system, any improvement due to treatment, whether the patient appears to be maintaining his strength or not, the appearance, increase or decrease of pain and of other subjective symptoms, and any alterations in diagnosis or treatment, with the reasons for such alteration. At the end there must always be carefully noted the Date of Discharge and the Result; a patient either 'Dies' or is 'Cured,' 'Relieved' or 'Discharged Otherwise.' When discharged otherwise, an explanation is always written on the diet sheet, *e.g.*, 'Absconded,' 'Own Request,' 'Moribund,' &c., and this must also be entered by the student. If a *post-mortem* examination is held, the result should be entered at the end of the case, and a reference given to the volume and page of the *Post-mortem* Journal in which the case is recorded.

In conclusion, a few words are advisable as to the Ethics of ward work. Familiarity in this case, as in others, is rather apt to breed contempt, or rather carelessness. Students of medicine are now so hard worked that any attempt at recreation of mind or body is to be welcomed—save in the presence of the sick. Most usually such exhibitions are due to simple thoughtlessness, but in this matter thoughtlessness is not permissible. No one who properly realises his position in dealing with the sick, and what it implies and entails, will be guilty of indecorum in a hospital ward. One other point must be alluded to. Certain words should never be used in the presence of sick persons, owing to the depressant or even more serious effects which may thus be produced. Examples of such are 'cancer,' 'malignant,' 'heart-disease,' 'hopeless,' 'very bad,' 'death,' and any other term calculated to alarm or disgust. Something else can always be substituted,[*] *e.g.*, carcinoma, recurrent, cardiac disease, &c., or the discussion of the prognosis can be avoided till a more convenient moment. Sometimes it is advisable to order a person a little 'coloured water,' or to discuss the question of his being ordered alcohol or opium, or of his possible addiction to the abuse of them. In such a case the word 'placebo' is convenient for the first named, 'C_2H_6O' for alcohol, '$CHCl_3$' for chloroform, 'extractum papaveris' for opium, and so on. A student, and even more a qualified medical man, who regards such matters as unimportant or as partaking of the nature of 'fads' is unworthy to practise a profession of which the watch-word is *noblesse oblige*.

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* *Vide* Part II, Chapter VI.

CHAPTER III.

CLINICAL EXAMINATION AND NOTE-TAKING OF SURGICAL CASES.

Record first the name, age, caste or race, occupation, residence and date of admission of the patient. Then proceed to examine into his history and the history of his present illness. Next note carefully what you observe regarding his general state, as well as the local diseased conditions that may exist. Let your examination be carried out with gentleness and patience, otherwise the patient may become frightened and confused, and you will be unable to elicit the information which you desire to obtain. It will generally be necessary to cross-examine the patient before you can arrive at a correct estimate of the history of the case. The following scheme is recommended :—

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[*] One of my most able and thoughtful teachers always used the term 'somatic change' for 'death.'

*Nature of the disease*____________________

(This is filled in after the diagnosis has been made.)

*Date of admission*____________________

*Date of discharge*____________________

*Result*____________________

Name ____________________

Age ____________________

(This is important, as different diseases tend to occur at special ages; for example tubercle in the young, cancer in those past middle life. When, as frequently happens, the patient does not know his age, the apparent age must be entered.)

*Occupation*____________________

(This is important as a means of diagnosis. Particular trades or occupations tend to produce or cause a predisposition to certain diseases.)

Residence ____________________

(This is also of importance. The locality may be malarious or noted for goitre, or stone, or elephantiasis.)

History.—This should include an inquiry into the family history and the existence of any hereditary predisposition to disease. All previous ailments or accidents must be inquired into. The period of commencement of the present illness and the symptoms and their progress up to the period of admission must next be noted, and the assigned cause and mode of production of the disease or injury. Note also the previous treatment that may have been adopted.

Condition on admission.—The main symptoms complained of are first noted, for instance, "complains of an ulcer on the leg." Next the state of development and nutrition; the presence or not of anæmia; evidences of any constitutional taint, such as *scrofula* (shown by state of hair, skin and glands; whether the fingers are clubbed or not; the presence of scars in the regions of the lymphatic glands); *syphilis* (as shown by scars of old abscesses or marks of skin, eruptions, nodes, sunken nose, destruction of palate).

The expression of the face.—Calm, excited, nervous, pained, haggard, sunken, pale or congested, puffy or wasted, cachetic; state of pupils.

Decubitus.—Whether patient lies on the back or side or in any peculiar attitude; position in which diseased or injured part is held.

Pulse.—Rate and character.

Temperature.

(NOTE.—The temperature must also be recorded on a chart.)

Skin.—Moist or dry, healthy or unhealthy. Note any stains or scars of importance.

Alimentary system.—State of tongue, digestion, action of bowels.

Urine.—Reaction, specific gravity, odour, clear or turbid, appearance of deposit if any, presence of albumen or sugar, nature of deposit if any.

Local examination.—This includes a minute examination of the organ or part of the body which is diseased.

(NOTE.—The points of inquiry into the condition of the respiratory, circulatory, digestive and nervous systems are described elsewhere.)

Genito-urinary system.—Micturition increased in frequency or not; pain present before, during, or after micturition; difficulty in micturition; urine passed in a stream or not; discharge from urinary organs and its character if present. Incontinence or retention.

Treatment.—Record in full the treatment as to appliances, medicines, operative interference, diet, &c.

Progress of the case.—All important changes in the symptoms and all new ones which arise should be noted at the exact time at which they occur. Note the date of any change in the treatment, or diet, giving the reasons. If operations are performed, their nature and object must be recorded and they must be described carefully.

Post-mortem.—If the case is fatal and a *post-mortem* is performed, the results of the autopsy must be noted.

The value of these 'cases' depends upon their conciseness and accuracy. It is well to remember, as a rule, that the history as given by the patient should be as brief as possible, whereas the abnormalities found on examination should be given in detail. A note should be entered in chronic cases at least once a week, recording the exact state of the patient, and any changes he may have gone through in the interval; in acute cases the entries should be made every morning, care being taken to record the exact progress of the case during the previous twenty-four hours.

The following are the chief points to be noted in reference to the more usual surgical ailments.

Acute inflammation.—Cause (idiopathic or traumatic); position and extent; circumscribed or diffuse; variety (simple or spreading); pains; redness; swelling; constitutional condition as shown by temperature, pulse, skin and digestive organs. Whether extending or subsiding.

Chronic inflammation.—Cause (scrofula, syphilis, rheumatism, gout, &c.); position and extent; pain; swelling; modifications of function; presence or absence of suppuration.

Abscess.—Position and dimensions; circumscribed or diffuse; presence of pain; fluctuation; constitutional disturbance; cause (idiopathic, traumatic, disease of bone, &c.); acute or chronic; treatment; nature and amount of contents.

Ulcer.—Cause (traumatic, constitutional or due to local causes); position; size; shape. Base (hard or soft). Floor (granulating or not; character of granulations; presence of slough or blood). Edges (raised or not, smooth or ragged or clean cut, undermined). Surrounding skin (thickened, pigmented). Discharge (thick, thin, watery, sanguineous, offensive). Variety (simple, indolent, irritable, inflamed, sloughing, eczematous, varicose, syphilitic, tubercular, malignant, lupoid, rodent).

Wounds.—Position. Variety (incised, contused, lacerated, punctured, poisoned). Dimensions. Note any complications, as hæmorrhage or presence of foreign bodies. Note also treatment before admission, amount of secondary inflammation, whether united by adhesion or granulation. In all cases of wounds due to assault or cases sent by the police great care should be observed as to the accuracy of the notes.

Gun-shot wounds.—How produced; the nature and velocity of the projectile; the extent of the wound; the organs, bones or vessels implicated; the position, size and appearance of the wounds of entrance, and exit if present, and whether there are any gunpowder stains on the skin. What was the probable position of the patient when he received the injury.

The time of the receipt of the injury, the state of wound when seen, the character of discharge if any, the amount of primary shock and its duration, the amount of reaction, the present state of the patient, the amount of primary hæmorrhage and its treatment. How the examination of the wound was performed, whether by finger or by any particular probe. If any foreign bodies have been extracted, as bullets, either whole or in parts, fragments of shell, bone, portions of the clothes, &c. Always examine the holes in the clothes to see if any portions are missing. Note the amount of fever, the progress of the case, its complications, treatment, and the result as to state on dismissal from hospital, and as to permanent injury.

Exhaustion and shock.—Note general appearance, posture, state of consciousness, of powers of volition, of muscular system, of eyelids and eyes, of expression of face, of sphincters, of action of bladder, of powers of speech, of intellectual powers, of pulse, heart and respiration ; note any tendency to coma ; note the temperature of the body, the powers of swallowing, any tendency to nausea or to vomit ; observe the state of the skin as regards colour and perspiration ; watch for any signs of increasing collapse or signs of reaction.

Bites of rabid animals.—Note when the bite was inflicted, the reasons for supposing the animal to be rabid, whether the bite was made through the clothing and what treatment, if any, was adopted at the time. The position, depth and extent of the wounds.

Burns and scalds.—Note their cause, their position, the *extent of surface* implicated, the degree in different parts, the amount of primary shock and reaction, the present symptoms, the progress, complications (particularly affections of the lungs, or hæmorrhages from the bowels), treatment, and result as to scars or permanent contractions or disfigurements.

Fracture.—Bone or bones implicated, simple, compound, comminuted or greenstick. How and when produced ; position and direction of the line of fracture ; amount of injury to vessels and soft parts. In compound fractures note the position and extent of the external wound ; if produced by the primary force or by the broken bone ; what vessels, nerves or joints are involved ; record the constitutional symptoms. Note the amount of primary shortening if any. Note all the primary symptoms and their changes, also the amount and duration of the shock. In fractures of the pelvis, or upper parts of the femur, always examine the state of the bladder. Note any change in the local or general treatment. Note the exact measurements on discharge and amount of deformity and loss of function if any.

Dislocation.—Articulation affected. How and when produced. Exact position of the bones. Nature of the deformity produced, amount of movement, alteration in length and axis of limb. Altered relations between bony prominence. Any injury of soft structures. Any pain, swelling, discolouration or crepitus. Treatment (by manipulation or extension; and whether under an anæsthetic). Result immediate and final.

Nelaton's line for judging the relations of the great trochanter in injuries of the hip is given as follows by Holden :—"If in the normal state you examine the relations of the trochanter to the bony prominences of the pelvis, you will find that the top of the trochanter corresponds to a line drawn from the anterior superior spine of the ilium to the most prominent part of the tuberosity of the ischium. This line also runs through the centre of the acetabulum. The extent of the displacement in dislocation or fracture is marked by the projection of the trochanter behind and above this line." Holden recommends that the thumbs be placed firmly on the iliac spines, while the fingers grasp the trochanters on both sides. Having the sound side as a standard of comparison, the hand will easily detect any displacement on the injured side. A rough and ready method of estimating displacement of the trochanter is by seeing how many fingers can be placed between it and the anterior superior spine, the two sides being compared.

When measuring the extremities in cases of fracture, always note the points you have measured from, and the length between the corresponding points in the uninjured limb. In the upper extremity, as a rule, measure from the acromion process of the scapula to the external condyle of the humerus, and from it to the styloid process of the radius. In the lower extremity measure from the anterior superior spine of the ilium to the lower border of the inner condyle, or the internal malleolus.

Head injuries.—Note the exact position and nature of injury and how and when inflicted. Whether any fracture of the skull can be detected, and, if so, whether the fractured portions of bone are depressed. Whether there has been any hæmorrhage from the wound (if any) or from the nose, mouth or ear. Note the general condition as to shock (pulse, temperature and breathing). Whether the patient is unconscious, and, if so, whether he can be roused or not. Note the condition of the pupils (dilated or contracted, equal or unequal, and whether they react to light or not). Whether there are any signs of paralysis of special muscles. The existence of convulsions. The state of the sphincters of the anus and bladder. Examine the urine for albumen.

Injuries of the spine.—Note the manner in which the injury was caused and the length of time that has elapsed since it occurred. Note any undue prominence in the line of the spines of the vertebræ or any tenderness. Whether pain is felt, and, if so, where. Whether there is loss of power in any of the muscles or any loss of sensation. Note whether there is loss of control over the sphincters of the anus or bladder or whether there is retention of urine. Whether there are any bedsores.

Carbuncle.—Note the duration of the disease. Position, size and relations of the carbuncle; whether inflammation is spreading or not; amount of pain and discharge; general condition; note whether there are symptoms of diabetes (thirst and polyuria). Examine the urine, noting particularly the specific gravity and the presence or absence of sugar.

Tetanus.—Note the alleged exciting cause. Whether there has been an injury, and, if so, its nature. Examine for the presence of a wound. Describe the primary injury, if any, and note whether any dust or dirt got into the wound at the time of the injury. Note whether the wound appears to be septic or not. Note the exact time between the receipt of the injury and the setting in of the earliest symptoms. Note the frequency, severity and duration of the spasms and the exact groups of muscles affected. Note the daily condition of the bowels and urinary secretion, the amount of sleep, the amount of nourishment taken, and the effect of remedies. Note, morning and evening, the state of the temperature, pulse and respiration. Note any special symptoms, such as retention of urine, spasm of the glottis, &c. In fatal cases note the mode of death (spasm or exhaustion).

Tumours.—Note the date of first appearance of tumour; whether it is growing rapidly or not, and whether there has been pain in it or not. Note the position, size and shape; whether circumscribed or not; whether freely moveable or not. Note whether the surface is smooth or irregular and whether the tumour is lobulated or not. Note its consistence, whether solid or fluid, hard or soft, and whether there is tenderness on pressure. If there is pain, note its character. Note if there is any sign of the tumour breaking down or if the skin over it has given way. Note the condition of the neighbouring lymphatic glands, whether enlarged or not. Is the tumour single or multiple. Note the state of the general health and whether there has been any loss of weight or strength since the tumour was first noticed. Is there any hereditary tendency to malignant disease. If recurrent, give the date of former operation.

Syphilis.—Date of chancre and its character and duration; followed by suppurating bubo or not. If there have been any constitutional symptoms, such as skin eruptions, sore-throat, headache, ulcers in the mouth or on the tonsil or tongue, mucous patches or condylomata, inflammation of the eye, pains in the bones, orchitis, nodes, gummata, and whether there has been loss of flesh. Note whether there is any induration at the seat of the chancre and whether there is enlargement of the lymphatic glands. Note the presence of any of the above symptoms. What has been the previous treatment. Has mercury been taken and, if so, how long and by what method.

Chancre.—Note the seat, number and size of the sores and their duration. Present appearance of sore must be described by the same method as other ulcers.

Epithelioma.—Seat of disease and its duration. Supposed cause. Presence or absence of pain or bleeding. Presence of enlarged glands. Present appearance of the sores must be described by the same method as other ulcers.

Elephantiasis.—Seat of disease and duration. Whether there are periodical attacks of fever accompanied by pain in the neighbouring lymphatic glands. The frequency of such attacks. Describe the tumours and the condition of the lymphatic glands which drain the affected area.

Nœvus.—Seat and size. Whether ‘capillary’ or ‘cavernous.’ Effects of compression. Congenital or not. Rate of growth. Is the skin involved. Is the growth consolidated or ulcerated; circumscribed or not?

Aneurism.—Seat. Single or multiple. Cause (spontaneous or traumatic). Describe its main characters by the same method as is done with other tumours. Compressible or not. Nature and degree of pulsation. Presence of thrill or bruit. Pain, œdema or other symptoms of pressure. The effects of pressure upon the tumours itself as well as on the proximal and distal portions of the vessel. Condition of the heart and great vessels. State of the general circulation of the limb. State of the skin over the tumour. Any complications, such as rupture or suppuration of the sac.

Diseases of bone.—What bone or bones affected. Supposed cause. Injury or not. Syphilis or tubercle. Presence and character of pain. Nature and amount of discharge. Any thickening of the bone. Condition of sinuses and whether diseased bone can be felt with the probe. Condition of bone (bare, resonant, rough or smooth, hard or soft, loose or firm). Condition of soft parts. Previous treatment.

Diseases of joints.—Note what articulation is affected, and if there is disease of any other joint or joints. Assigned cause. Evidence of tubercle, syphilis, gout, rheumatism or any nervous disorder. Duration. Symptoms in the order of their appearance. Did pain or uneasiness precede swelling or was it coeval with it. Presence of enlargement and amount as compared with corresponding healthy joint. Nature of swelling, whether uniform or limited to particular spots. Consistence, soft or hard or fluctuating. Degree of mobility. Any displacement of bones. Any grating sensation on moving the joint. Any relaxation of ligaments. State of surrounding soft tissues and skin. Presence of abscesses or sinuses. Character and position of fistulæ and nature and amount of discharge therefrom. Development of affected limb. Seat, nature and degree of pain. Whether pain is caused by particular movements or by pressure on particular spots, or by pressing the articular surfaces together. Are there startings of the limbs at nights. Is the pain aggravated at nights. Constitutional symptoms. Presence or not of hectic or signs of albumenoid disease, or tubercle. Note the previous treatment.

Ankylosis.—Which joint affected. Assigned cause and duration. Any displacement of bones. Whether immobility is absolute or not. Whether there is pain on movement. Condition of limb as regards development and nutrition.

Hip-joint disease (see Diseases of Joints).—Note position of limb. Shortening real or apparent. Twisting of pelvis. Lordosis. Position of sinuses.

Diseases of bursæ (see Tumours).—Any communication with neighbouring joints.

Bronchocele or goitre (see Tumours).—Note particularly whether consistence of tumour is hard or soft. Presence or absence of cysts. If cysts are present note their position and size. Whether the whole or what portion or the gland is affected. Whether respiration, deglutition or phonation are affected, and, if so, to what degree. Whether the larynx or great vessels are displaced or not. Whether the veins of the neck or face are swollen. Presence of headache, giddiness or drowsiness. Is there any pulsation. If so is it distensile in character and synchronous with the heart's action.

Diseases of upper jaw.—Any tumour; if so, describe it. Any bulging towards eye, nose or mouth. Any obstruction of lachrymal duct. Any discharge from nostril or sockets of teeth. Any disease of gums or teeth. Pain, its seat and character. Duration of disease. Any implication of glands.

Dysphagia.—Date of onset. Character. Any history of poisoning by corrosives. Is there most difficulty with solids or fluids. Is there any regurgitation of food, and, if so, how long after swallowing and how changed. Where does the patient locate the seat of obstruction. Has the invasion been rapid or slow. Is there any expectoration of blood or pus. Are there any signs of aneurism of the great vessels (dyspnœa, cough. state of pupils, pulsation, bruit, &c.) Are there any tumours in the neck. Any nervous affections or paralysis. Any obstruction to be felt in the pharynx. State of the glands of the neck. Seat and nature of pain. Result of attempts to pass an œsophogeal bougie.

Hernia.—Note its variety and duration. Whether a truss has ever been worn or any operative treatment been adopted. Whether it is reducible or not. If not, how long has it been irreducible. Note its characters (*see Tumours*). Is it resonant or dull on percussion. Reducible or not. Any impulse on coughing. When reduced, does it slip back suddenly with a gurgling noise.

When strangulated note the duration of strangulation. Has there been vomiting, and, if so, the character of vomited matter. Has there been complete obstruction. Note the general condition (temperature, pulse and respiration). Note the amount and location of pain. Condition of the tumour (tense, fluctuating, resonant or dull). Note the previous treatment and whether violent attempts at reduction have been made. If taxis is tried, note the result. When herniotomy is performed, note the steps of the operation. Note the cause of constriction; the presence of fluid in the sac; the nature and condition of the contents. The treatment of the contents of the sac and of the sac itself. After-treatment.

Intestinal obstruction.—Note when the symptoms set in, and if the onset was sudden or gradual. Note the symptoms in the order in which they occurred. The presence of pain, its seat, character and duration. Vomiting, its frequency and the character of vomited matters. Whether obstruction has been absolute. Whether any flatus has passed per anum. Whether any blood or mucus has been passed per anum. Whether urine has passed or not.

Any history of hernia, abdominal inflammation, dysentery, diarrhœa or gall stones. Note the general condition of the patient (pulse, temperature, respiration and appearance of face), any hiccup. Note the condition of the abdomen. Amount and position of swelling. Amount and position of distension. Amount and position of tenderness and pain. Whether any tumour can be felt. If so, its position and characters. Any movement of intestine seen or borborygmi heard. Note the amount of urine secreted. Examine for the presence of hernia. Explore the rectum and note the result. State the result of enemata, if any, are administered.

Fistula in ano.—Duration. Assigned cause. Position of opening. Amount and nature of discharge. Condition of surrounding tissues. Examine with a probe and note the direction and length of the canal, and whether it opens into the bowel. If so, at what point.

Hæmorrhoids.—Duration. Whether external or internal. Pain, its character and position. Whether the piles prolapse at stool, and, if so, whether they are returned with ease or difficulty. Whether much bleeding occurs. Note the general condition of the patient, and if he is anæmic. Note the position, size and character of the hæmorrhoidal tumours.

Stone in the bladder.—Date of earliest symptoms. Whether symptoms were preceded by passage of sand. Any attacks of renal colic. Amount and seat of pain. Whether pain is greatest before, during or after the act of micturition. Frequency of micturition. Is the stream of urine ever suddenly arrested. Is there ever retention or incontinence of urine or straining during micturition. Is blood ever passed. Note the condition of the urine. Can any stone be felt by palpation over the bladder. Note the result of sounding for stone (*see Chapter on Examination of the Bladder.*)

Diseases of the urinary organs.—Sir H. Thompson suggests four questions: *first, Have you any, and if any, what frequency in passing water;* is it more by day or night; is it influenced by movements or by any particular circumstance; *second, is there any pain in passing urine;* if so, is it before, during or after micturition; is it constant, is it produced or aggravated by quick movements, what is its exact locality; *third, Is the urine altered in appearance, or is there anything unusual in the stream itself;* urine is often passed clear and becomes turbid on standing, which may deceive a patient; *fourth, has blood ever been passed in any way with the urine;* if so, is the mixture florid or brown, light or dark; are the blood and urine intimately mixed, or is the blood chiefly passed at the end or at the beginning of making water, or does it issue independently of micturition altogether.

In the examination of the urine in diseases of the genito-urinary tract, Sir H. Thompson lays great stress on the importance of getting a true specimen of the urine from the bladder itself, by always getting the patient to pass the first few drops into a separate glass to clear the urethra. In cases of disease of the bladder where it is necessary to see if the urine is albumenous from changes in the kidney, or to try and find renal casts, he recommends that the bladder should be completely emptied, either by the natural powers or by the use of a soft flexible catheter, and that it should be, if necessary, washed out. A catheter should then be passed and allowed to remain in the bladder with the intention of drawing the urine off as it passes from the ureters.

Hæmaturia.—Duration of disease. Is it constant or paroxysmal. Is it profuse or slight in amount. What other symptoms accompany it. Is it brought on or aggravated by exercise. Is there any pain; if so, where and when. Examine the urine. Is the blood diffused or does it occur in minute masses. Does it precede, accompany or follow the flow of urine. State the result of examination of the genito-urinary tract and of the microscopic examination of the urine.

Gonorrhœa.—Duration. Amount and character of discharge. Amount of pain. Presence of complications, such as epididymitis, orchitis, cystitis, or rheumatism.

Stricture of urethra.—Duration. Whether due [to gonorrhœa or traumatism. Whether urine is passed in drops or in a stream. If fistulæ are present, the date of their origin. Note the frequency of micturition. Note the exact position of the stricture and its calibre. Whether there is induration or not of the perinæum and scrotum. The position of fistulæ. Examine the urine. Note the presence of any complications, such as cystitis, disease of the kidneys, 'urethral fever,' abscesses, &c.

Extravasation of urine.—Duration. Cause. Extent of extravasation. Condition of affected tissues. General condition. Whether a catheter can be passed or not.

Scrotum—*Swellings of.*—Duration. Position of the swelling at the commencement of the disease. Progress of symptoms. Describe the tumour (*see Tumours*). Pain present or absent. Its character, if present. Is the skin affected. What structures are implicated (scrotum, testicle, epididymis, or cord). Is there an impulse on coughing. Can the tumour be reduced into the abdomen. Is the external abdominal ring free. Are the inguinal glands enlarged. Is it œdema, inflammation, abscess, or cancer of the scrotum. Is it hydrocele, hæmatocele, orchitis or any other disease of the testicle. Is it epididymitis, varicocele, lymphangiectasis of the cord, or hernia. Is it elephantiasis or lymph scrotum. Results of exploration if any be required.

CHAPTER IV.

METHODS OF PHYSICAL EXAMINATION.

In order for the due appreciation of the methods employed in the physical examination of a patient, the student must be thoroughly acquainted with the superficial and deep anatomy and with the general physiology of the human body. In making such an examination, which is almost entirely objective, the various senses of the observer, viz., the visual, tactile, auditory, and even the gustatory and olfactory, are made use of, singly or in combination. The different methods are known as inspection, palpation, percussion and auscultation. In the case of the alimentary, respiratory and circulatory systems, the above order is always to be maintained in making an examination.. In the case of the nervous, urinary and other systems, these methods have more limited, but not less useful, applications. Only the general principles upon which these methods are founded will be described in this chapter; their special applications must be studied under the examination of the individual systems. The first essential for the student is to take every opportunity of accustoming himself to apply these methods to the normal or healthy human person as previously advised.

Inspection.—For purposes of exact description and comparison, the body superficies is divided into certain areas or regions, as indicated in the illustrations, and it is the knowledge of the relation of the underlying structures, in health and in disease, to these regions, which constitutes the foundation of physical examination. In addition, any point in the body can be accurately defined by means of the point of intersection of two imaginary lines—vertical and horizontal, —starting from fixed points. For this purpose certain bony prominences are chiefly used. Finally, the student must seek by memory and personal observation to gain a clear idea of corresponding levels on the anterior and posterior surfaces of the body, so as to be able, *e.g.*, to place his finger on a point corresponding to the bifurcation of the trachea or to the lower end of the œsophagus in front and behind. Inspection may conveniently be subdivided into (*a*) *general* and (*b*) *local*. The former has been already discussed in Chapter II.

Local Inspection.—By this term is signified the careful and detailed survey with which the systematic objective examination of each system should commence, following upon certain questions as to subjective phenomena. The first essential is that the patient be placed in a good light. The upright position is more suitable in some cases, *e.g.*, routine examination of thorax, the recumbent in others, *e.g.*, in inspecting the abdomen, whilst sometimes it is advisable to inspect under both conditions. Experience will soon teach the necessary precautions and modifications. Frequently certain instruments are made use of to assist us, especially in the inspection of mucous passages. Such are the various *specula* which, by means of light reflected from silvered surfaces and by keeping up artificial dilatation, enable the observer to get an excellent view of the nares, the external auditory meatus, the rectum, &c. More specialised instruments are the laryngoscope, ophthalmoscope and cystoscope; but the use of all such instruments can only be properly learned by actual demonstration and practice. *Mensuration* is also conveniently considered as being a form of inspection. The measuring tape and aniline pencil are among the primary requisites which every student should carry when doing clinical work. By their means the circumference and expansion of the thorax may be measured, as also the girth of the abdomen, the apparent size of tumours, the relative size of paralysed and healthy limbs, &c., and any increase or decrease from the original measurement noted from time to time. In addition, the tape is often of great value in fixing a point from which an imaginary line may pass. For surgical work mensuration is constantly of the highest importance. During the carrying out of inspection, the student should accustom himself to proceed in a methodical way, noting first the shape or contour, then the size (mensuration), thirdly the colour, and, fourthly, the mobility, as to its nature and degree, where necessary.

Palpation.—This method is largely used as a means to confirm or check the impressions gained by inspection, but it has, besides this, a very extended application in all varieties of physical examination—medical, surgical, gynecological, &c. That 'practice makes perfect' is especially true of palpation, and the student must seize every opportunity to palpate, with due regard to the well-being of the person palpated. Here, again, the examination must be methodical; first, shape and contour; second, size; third, effect on the colour, *e.g.*, redness disappearing on pressure but immediately returning on its removal; fourth, the mobility of the part and the effect of pressure; fifth, the presence or absence of fluctuation. There are many other useful points upon which information may be elicited, *e.g.*, the condition of the skin as to thickness, dryness or the reverse, smoothness, &c.; the presence or absence of cardiac and respiratory thrills; the distribution of pain; the warmth of inflammation or the coldness of failing circulation; exaggeration, diminution or absence of tactile sensibility, &c.

In the examination of the abdominal system, palpation is of the greatest use, because there are so many different organs and because they are only separated anteriorly from the hand by the comparatively soft muscular wall of the abdomen. In order for successful palpation in this region the golden rule is not to use the finger tips, but the pulp of the fingers. The hand should be laid gently on the abdomen, *away* from the affected portion, at the same time that the patient's attention is diverted. If necessary, he may be made to bend his legs and to open his mouth or to talk, in order to relax the abdominal muscles.* The examiner's hand should glide gently from point to point with a motion like that of a caterpillar, whilst a varying degree of pressure is maintained. With practice, any deviation from the normal is very quickly detected. In palpating the margin of the liver, another method is advisable. The examiner, if using his right hand, stands on the right side of the patient and lays his hand transversely across the abdomen below the level of the umbilicus. He then, keeping the hand flat and exerting some pressure, palpates slowly upwards, moving the index finger about as a 'pilot' to detect any marked increase in resistance, and confirming the impression thus gained by deep pressure with the side of his middle finger maintained in a horizontal position to the vertical axis of the body. Anything like a 'digging' action is useless for detecting slight or deep-seated enlargement; whilst it is just in such cases that palpation is most useful. For ascertaining whether fluctuation is present in any swelling the two index fingers should be used as palpators, and for certain deep-seated tumours the two hands may be used, one placed posteriorly and the other anteriorly so as to compress or fix the mass.† Sometimes palpation is combined with percussion, *e.g.*, in the detection of fluid within the peritoneal cavity. In this latter case, it is necessary to remember that, *unless the vibration of the abdominal wall is prevented* by the pressure of a book or chart holder held upon the linea alba, the presence of a 'thrill' is not diagnostic of fluid.

There are many other special ways of applying palpation which the student will learn or discover for himself. The great thing is to educate his fingers to appreciate slight differences, at the same time that he learns the natural 'feel' of all parts of the body.

Percussion.—By this term is denoted the practice of eliciting information as to the physical condition of various portions of the body—especially the viscera—by means of the sounds produced on tapping or 'percussing' the surface. Roughly speaking, the sounds so produced differ according as the part percussed contains much underlying air, a little, or none at all.

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* Sometimes the administration of chloroform may be necessary or the hypodermic injection of morphia. In obscure and difficult cases, Sir B. W. Richardson advocates the palpation being performed whilst the patient is in a hot bath. I have found that continued poulticing for twelve hours previously is occasionally very useful.

† In certain cases, chiefly surgical or gynecological, 'bimanual' or two-handed palpation is most useful, especially where one hand or finger is inserted into the rectum or vagina, whilst the other palpates the surface of the abdomen.

There are two varieties of percussion, known, respectively, as 'immediate' and 'mediate;' the latter is by far the more important. In immediate percussion, the tip of the finger is used for tapping the surface directly, as in percussion over the clavicular region of the thorax.* Sometimes a hammer or 'plessor' is used instead of the finger for striking, whilst an ivory, wooden or vulcanite plate or 'pleximeter' takes the place of the finger struck. For general work the fingers are much more satisfactory. Personal demonstration and practice are the only means for learning the art properly; but there are one or two points the student must remember. Firstly, whichever fingers be chosen the use of these same fingers must be adhered to until the student is thoroughly proficient.† Secondly, the pleximeter finger must always be struck in the same place, preferably just over the distal phalangeal joint, and this finger must be placed quite flat and firm so as to exclude the presence of air between it and the skin. The slightest raising or bending alters the sound. Thirdly, percussion is to be made entirely with the wrist and not from the elbow.‡

Percussion is not simply a question of sound difference. Another factor has to be taken into account, viz., the varying sense of resistance conveyed to the finger. This will be referred to again. As regards the sounds themselves, only a few are truly musical, *i.e.*, are 'notes'. Most of them are made up of a large number of different tones produced by vibrations of varying lengths.§ Three leading qualities or descriptions of sounds occur in percussion, viz., (1) the Dull sound, as in percussion over the thigh or in the region of 'absolute' hepatic dulness; (2) the Clear sound (non-tympanitic) or normal lung sound, as elicited on percussion over normal spongy air-containing lung *within* the thorax; * (3) the Tympanitic sound, which is approximately a true musical sound with a recognisable pitch, a note in fact. It commonly occurs when the stomach or colon is percussed and may be elicited by percussing the cheek when *moderately* distended. These two latter, the clear sound and tympanitic sound, occur in all degrees of relative clearness and dulness; indeed, the former may pass imperceptibly into the latter, and either may lead by very gradual transition to (1) the dull sound. For example, let the student percuss himself *very lightly and slowly* from the right infra-clavicular region to the sixth interspace in the mammary line.† He will then be able to appreciate the gradual alteration in the quality of the sound from clearness to dulness. Again, let him percuss himself from the right iliac region upwards, or from the left hypochondriac region transversely, to the region of absolute hepatic dulness.‡ He will then hear the various transition sounds from tympany to absolute dulness. By these and similar trials on himself and others he will acquire a knowledge of percussion sounds which will prove of the greatest value to him in examining diseased persons.

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* A variety of immediate percussion is 'flipping,' as used by some persons in examining the abdomen. It is, however, a defective method and much more accurate results are obtainable by light mediate percussion.

† The middle finger of each hand is probably the best.

‡ Comparable to the *staccato* touch on the pianoforte.

§ "Between a pure and simple musical sound produced by a series of vibrations, each of which has exactly the same wave-length, and a harsh noise in which no consecutive vibrations may be alike, there are numerous intermediate stages."—*M. Foster.*

The presence of fluid has the same effect in diminishing the resonance, raising the pitch and increasing the resistance as any solid body, the reason for its doing so being similar, viz., diminution in the quantity of air. In the case of clear sounds, although they are not true musical notes and have therefore no true pitch, it is possible to recognise differences in general height or depth, and these differences are conveniently described clinically as differences of 'pitch.' Further information regarding percussion sounds must be sought in Chapters V, VI and VIII, but the student, when percussing any region and comparing it with the normal, or in comparing any two regions together, must carefully note (*a*) the *degree of resistance* ; (*b*) the *intensity* or *relative duration* of the sound ; (*c*) the *pitch* of the sound, as any one of these factors may differ whilst the others are identical. If he simply notes dulness or the reverse he will fail of ever becoming a past master in the useful art of percussion. Lastly, percussion should in nearly every case be gentle, with the following exceptions : (1) where the parietes are thick from abundance of fat or muscle ; (2) where the organ percussed lies deeply, *e.g.* (*a*) percussion of the lungs posteriorly, (*b*) percussion of the left edge of the heart (overlapped by lung). Occasionally it is advisable to percuss (*a*) gently, (*b*) strongly, for special reasons, but experience soon teaches what is suitable.

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* The lung itself when percussed directly, *post mortem*, yields a tympanitic note, due to relaxation of the tissue and lessening of the amount of air.

† All accurate percussion should be done in the absence of the slightest distracting noise. It is next to impossible to obtain even comparative silence in and about a hospital ward in India, and all large hospitals in this country should be provided with a special room that can be completely closed for the purpose of accurate percussion and auscultation of patients.

‡ Not immediately after a meal. When lying quietly in bed at night the various sound differences can be accurately appreciated. If one part of the abdomen is dull another part is sure to be tympanitic.

Auscultation.—Theoretically, the listening to, and investigation of, any sounds produced by the physiological action of the body are included under auscultation, but practically all sounds plainly audible at a distance, such as coughing, are examined and noted during inspection. Auscultation is almost entirely confined to the respiratory and circulatory systems; but it has certain applications in the examination of the abdominal and other systems. Like percussion, it is divided into 'immediate' or direct and 'mediate' or indirect. In the former case the ear is applied directly to the body surface ; in the latter some form of 'stethoscope' is made use of. There are two chief forms of this instrument, the single and the double (binaural). As the former is preferred by nearly all authorities, its use will be referred to alone. It consists of a wooden tube expanded at one end into the ear-piece and at the other into the chest-piece.* The following points should be attended to in purchasing one. It must be made of *one piece* of light wood, the ear-piece being *slightly* hollowed and the chest-piece not more than 0·75 inch in internal diameter. If the ear-piece is too large, so that it rests upon the helix and the zygomatic arch, or too curved, extraneous murmurs will interfere with the auscultation. If the chest-piece is too large it will be impossible to auscultate the supra-clavicular region or the intercostal spaces satisfactorily, particularly in the case of Hindus in Southern India. Once a student obtains a stethoscope that 'fits' his ear he should take great care of it and *use no other.*[*]

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* There are endless varieties of stethoscope as to construction, material, &c. The simplest is the best. The newest is one made on the principle of the violin sound post, but I have had no opportunity of testing it. There are also the *phonendoscope* and *stethonoscope*, instruments which magnify or intensify the natural sounds.

There is no doubt that the direct method is far too much neglected. Indeed, it is not rare to meet medical men who are unaware of its feasibility. It is specially useful in doubtful cardiac cases and also in rapid examination of the respiratory system in a bad case, since by this method a larger region of lung can be auscultated at once and the sounds are collectively louder. The listener must not lean his head heavily on the patient so as to press the tragus of his ear inwards.

In using the stethoscope it is essential to fit that instrument accurately upon the region to be auscultated and, *keeping it thus adjusted* by means of two fingers, to lay the ear gently upon the ear-piece. The beginner invariably fits the stethoscope to his ear instead of adjusting his ear to the stethoscope. Anything like undue pressure is to be carefully avoided,[†] whilst, on the other hand, if the chest-piece is not kept accurately fitted to the skin, the resulting air currents will give rise to distracting murmurs.

In every case, whether of mediate or immediate auscultation, the listener must avoid a strained position. If the patient is able to stand he should generally be directed to do so.

The special applications of this method to the examination of the different systems must be learned under their appropriate chapters. Occasionally, and particularly in suspected pneumothorax, auscultation is combined with percussion.

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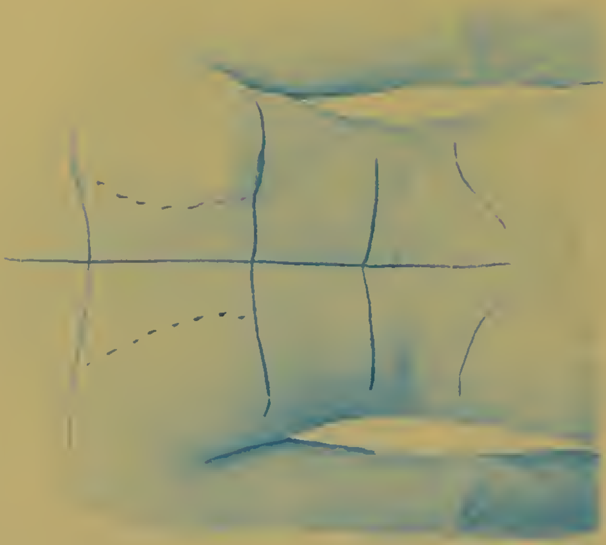
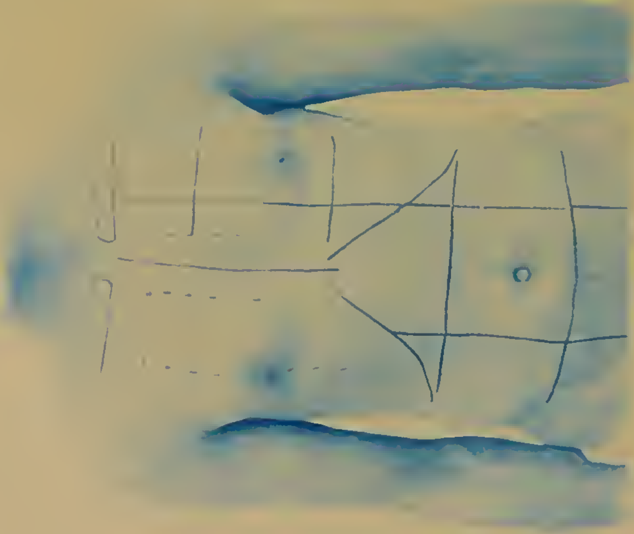
[*] "In my teaching I have always found that those students, who, each time they wished to make an examination, had to borrow an instrument from their fellows, did not hear anything."—*Vierordt.*

[†] Save in special cases, *e.g.*, where the observer is trying to distinguish between crepitation and faint pleuritic friction.

PLATE I





To face p. 46.

PLATE I.—LINES AND REGIONS OF THE BODY SUPERFICIES.

To show division of the trunk superficies anteriorly (fig. 1) and posteriorly (fig. 2) into certain areas or regions by means of natural boundaries and imaginary vertical and horizontal lines. [From a photograph.]

The lines are—

1. Median line = mid-sternal, anteriorly; vertebral, posteriorly.
2. Mammary line = drawn through the nipple (shown 'dotted' on right side of thorax).
3. Sternal line = right and left edges of sternum (shown 'dotted' on both sides of the sternum).
4. Parasternal line = drawn midway between sternal and mammary lines (shown on left side and continued downwards to middle of Poupart's ligament).
5. Anterior axillary line = drawn from anterior fold of the axilla (not shown).
6. Mid-axillary or axillary line = drawn from apex of the axilla (not shown).
7. Posterior axillary line = drawn from posterior fold of the axilla (not shown).
8. Scapular line = drawn vertically through inferior angle of scapula (not shown).

The two vertical lines on the abdomen are simply the parasternal lines prolonged downwards to the middle of Poupart's ligaments. The horizontal lines, anteriorly, are on (1) the upper and lower margins of the clavicle; (2) the third rib; (3) the sixth rib; (4) joining the lowest points of the costal arch (the oblique lines running downwards and outwards from the end of the sternum follow the curve of the costal margin); (5) joining the anterior superior spinous processes of the ilia. The horizontal lines, posteriorly, are on (1) the spines of the scapulæ; (2) two points just below the inferior angles of the scapulæ (the vertical borders of the scapulæ are indicated by dotted lines); (3) the inferior margins of the lowest ribs.

The regions are—

Anteriorly, thoracic—

(1) Supra-sternal or notch.
(2) Superior sternal = as far as lower border of third rib.
(3) Inferior sternal = to lower end of sternum.
(4) Supra-clavicular = above inner half of clavicle.
(5) Clavicular (shown enclosed between lines).
(6) Infra-clavicular = to lower border of third rib.
(7) Mammary = to sixth rib.
(8) Infra-mammary = to costal margin.

Anteriorly, abdominal—

(9) Epigastric	Three central regions, from above downwards, as indicated in fig. 1.
(10) Umbilical	
(11) Hypogastric	
(12) Hypochondriac	Three lateral regions, from above downwards, as indicated in fig. 1.
(13) Lumbar	
(14) Iliac	

[NOTE.—The hypochondriac regions are larger than they appear superficially, since their upper limit is the diaphragm and not the costal margin. To a certain extent, therefore, the infra-mammary and hypochondriac regions overlap. For contents of the abdominal regions, *vide* Chapter VIII.]

Laterally—

(1) Axillary = from apex of axilla to sixth rib.
(2) Infra-axillary = from sixth rib to costal margin.

Posteriorly—

(1) Supra-spinous = to level of spine of scapula. (A distinction is sometimes made between supra-spinous and supra-scapular, but it is unnecessary.)
(2) Scapular = from spine to inferior angle of scapula.
(3) Inter-scapular = between vertebral border of scapula and median line.
(4) Infra-scapular = from inferior angle of scapula to lower border of the last rib.
(5) Lumbar (posterior) = to border of ilium (the iliac crests are indicated by curved lines).

CHAPTER V.

EXAMINATION OF THE RESPIRATORY SYSTEM.

Before studying disease, it is necessary to be acquainted with anatomy and physiology, and also to have an accurate knowledge of the physical signs in health.

In the tissues of the body during life arterial blood is constantly being changed into venous blood. The main function of the respiratory apparatus is to again convert this venous into arterial blood. Respiration also assists the circulation of the blood.

The tissues of the body not only deprive the red blood corpuscles of a good deal of oxygen, but they also yield to the blood a large amount of carbonic acid and other waste products.

In the capillaries of the lungs the blood is brought into close communication with air; it recovers its lost oxygen, and gets rid of carbonic acid and a small amount of water. For the proper oxygenation and purification of blood in the lungs a constant supply of fresh air must be brought into the neighbourhood of the pulmonary capillaries. It is by the acts of inspiration and expiration that the necessary change of air is brought about.

The thorax is, roughly speaking, conical in shape, with its apex at the root of the neck, while the diaphragm forms its base. By means of the trachea, larynx and pharynx there is direct communication between the bronchi of the lungs below and the inlets of the mouth and nose above. The wall of the thorax is, for the most part, lined with smooth, moist, serous membrane (pleura), and this lining membrane is reflected over the lungs so that its two layers are in close apposition. By the contraction of the diaphragm (*diaphragmatic respiration*) the vertical dimensions of the thoracic cavity are increased. When the ribs are raised by the contraction of the external intercostal muscles, there is an increase of the horizontal dimensions of the cavity (*costal respiration*). By one or both of these forms of *inspiration* additional air is drawn into the lungs. A similar quantity is soon afterwards expelled by the act of *expiration*, in which, the inspiratory muscles having ceased to act, the elasticity of the lungs and chest wall comes into play, and the thoracic cavity is diminished in size. In men, respiration is principally *diaphragmatic* or *abdominal* ; while in women it is mainly *costal.*

In certain forms of disease, in which there is some obstacle to the proper aëration of the blood, respiration is quickened and extraordinary muscles of inspiration and expiration are called into play. The former muscles assist inspiration mainly by pulling up and fixing the two first ribs. The latter, most of which connect the sternum and ribs with the pelvis, aid expiration by pulling down the ribs and by forcing up the diaphragm.

The nervous centre which, through the intercostal and phrenic nerves, mainly regulates the rhythmic movement of the respiratory apparatus, is situated in the medulla oblongata, and is called the respiratory centre. The rapidity and force of the inspiratory and expiratory acts appear to depend on the condition of the blood circulating in the capillaries of the medulla. They also are affected in a reflex manner by impulses passing up to the medulla along the pneumogastric nerves from the lungs and along other nerves.

Coughing is a violent expiratory act. It may be voluntary, but is usually excited reflexly. There is first a deep inspiration : then the exit is closed and violently burst open by forced expiration. It is by coughing that morbid secretions and foreign substances generally are removed from the respiratory apparatus.

Cough is usually due to an irritable condition or direct irritation of some portion of the air-passages, especially the throat and larynx. It is important to examine the throat therefore in all cases of cough. In some cases cough is *reflex* and associated with irritation in the lungs, pleura, heart, pericardium, alimentary canal, ear, &c.

The following points should be noted about cough:— Its frequency, and whether constant or paroxysmal. The severity and duration of the fits. The mode of onset and whether brought on by some obvious cause, such as exertion, change of posture, inhalation of cold air or dust, &c. Its character. The chief varieties of cough are hacking, hoarse, wheezing, barking, ringing, metallic or brassy, croupy, whooping and aphonic. It should specially be noted whether the cough is dry or attended with expectoration, and whether expectoration is effected easily or with difficulty. It is important to make a careful examination of the *sputa*, and note the quantity ; colour ; odour ; whether in one mass or in separate lumps ; transparency or opacity ; amount of frothiness, consistence and degree of adhesiveness; presence of blood, fibrinous casts, or calcareous particles; microscopic characters. Also note if the cough terminates in vomiting; or is followed by relief of any unpleasant symptoms.

When a liver abscess bursts through the lung the expectoration has a characteristic pink appearance.

PHYSICAL EXAMINATION.

When the ear is applied directly or by means of a stethoscope to any part of the chest over the lungs certain *respiratory sounds* are audible. They accompany inspiration and expiration, and are louder over the bronchi than over the general surface. Three typical sounds may be heard over different parts of the respiratory apparatus in a healthy subject.

1. **Tracheal or laryngeal.**—This sound is heard immediately over the wind-pipe in the front of the neck. It is loud, more or less hollow and high-pitched; there is a marked interval between its inspiratory and expiratory portions, the latter is prolonged.

2. **Bronchial.**—This sound is less loud and high-pitched; it has a harsh quality; the interval between inspiration and expiration is not so well marked as in the tracheal sound. Bronchial breathing may be heard normally in many persons in the interscapular regions; also about the upper part of the sternum.

3. **Pulmonary or vesicular.**—Over the greater part of the chest whenever the lung comes in contact with the parietes the *vesicular murmur* or *vesicular breath-sound* will be heard during respiration. As a rule the student at first finds it very difficult to hear anything at all during quiet breathing in a healthy adult. On careful examination, however, in a quiet room or ward a soft and feeble blowing sound will be heard occupying the whole of the time of inspiration but synchnous with only the first one-third of the time occupied by expiration. The remaining two-thirds of expiration will not be accompanied by any sound at all. In many individuals, indeed, an expiratory sound is quite inaudible and the student should remember that the loudness of the vesicular murmur varies inversely as the thickness of the chest-wall, and is therefore more difficult to hear in stout than in emaciated persons. Breath-sounds that are neither *bronchial* nor *vesicular* but are intermediate in quality are heard in

the interscapular region in many persons. In all children the vesicular murmur is very loud and the expiratory part of it is nearly as long and as loud as the inspiratory. This kind of breath-sound is called *puerile.*

The normal rate of respiration of adults is *about* 17 per minute. In infants it may be 40 or even more.

The signs which draw attention to disease of the respiratory system are :—

1. **Morbid sensations** about the throat, neck and chest. There may be uneasiness, soreness or pain over the part affected. These sensations are often intensified by speaking, coughing or deep breathing. Tenderness is sometimes noticed over the seat of disease. Actual pain about the chest is more often due to disease of the chest-wall or of the pleura than to mischief in the lung itself.

2. **Disturbance of breathing.**—There may be quickened respiration or laboured breathing. In laryngeal and tracheal diseases breathing is often noisy and stridulous. *Dyspnœa* is the term used to express difficulty of breathing ; when the dyspnœa is so bad that the patient has to sit up it is called *orthopnœa.*

3. **Coughing—Sneezing.**—The object of these acts is to get rid of some source of irritation.

4. **Expectoration.**

5. **Alteration in character of voice.**

The different methods of examination of the chest are :—

1. **Inspection.**—By this we note the state of chest-wall, the shape and size of chest, want of symmetry, and the character of the respiratory movements. Slight differences between the shape of the two sides almost always exist even in healthy persons.

The student should, as soon as possible, become familiar with the shape of a normal chest, that of the rickety chest, emphysematous or barrel-shaped chest, pigeon breast, alar chest ; deformities due to Pott's curvature of spine, lateral curvature of spine, retractions of one side of the chest due to previous disease and the falling in and flattening of the chest commonly seen in pulmonary tuberculosis. The movements of the chest will also be noted, and any modification of the normal movements noted, such as :

(1) Diminished expansion, general or local.
(2) Increased expansion, general or local.

(3) Falling in of intercostal spaces or spaces above the clavicle.
(4) alteration in rhythm or rate of breathing.
(5) the amount of action of the diaphragm.

Chests often deviate considerably from the normal even when there is no active disease. A chest may be *contracted*, this condition being either congenital or acquired. Two forms of small chest are met with, namely:—(*a*) that in which the ribs are very oblique; the chest is long and narrow; the costal angles are very acute, and the scapulæ are often tilted up behind, so as to resemble wings; (*b*) that in which the front of the chest is flattened, so that the antero-posterior diameter is very small.

In infancy and childhood, when the thoracic walls are very yielding, deformities of the chest are often originated in consequence of an insufficient amount of air entering the lungs during the act of breathing. This may be due either to some obstruction in the air passages; to a weak condition of the muscles which expand the chest; or to both causes combined. As sufficient air does not enter the lungs the chest wall falls in to some extent during the descent of the diaphragm. Such deformities may be brought about by bronchitis; whooping cough; laryngismus stridulus; croup, and enlargement of the tonsils.

2. **Palpation.**—In this method the palmar surface of the hands and fingers are applied to the chest. The objects of palpation are to get more accurate information with regard to what is revealed by inspection; to detect the presence of fluctuation; to determine the existence and character of various kinds of *fremitus* such as, (*a*) *vocal fremitus* or sensation conveyed to the surface of the chest by the act of speaking or crying, (*b*) respiratory *fremitus* produced by the act of breathing, (*c*) *friction fremitus* resulting from the rubbing together of the two surfaces of pleura roughened by disease.

3. **Mensuration.**—Measurements of the chest can be made in several ways. The circumference of the chest is most commonly measured at the level of the nipple in the male, the measuring tape being placed first round the chest in full expiration and kept on whilst the patient is directed to expand the chest as much as possible. If there is any reason to suppose that the two sides are not acting to the same extent the amount of expansion of each side may be measured by joining two measuring tapes at the commencement of their scales and fixing their point of junction over the spinal

column. Each side of the chest has then a tape for itself and simultaneous measurements can be made and compared. In most right-handed persons the right side of the chest is about half to one inch larger than a left and *vice versâ*.

The *cirtometer* is used to enable the physician to reproduce on paper an outline section of the chest-wall: it consists of two bands of soft metal joined at the middle. The joint is held over the spine and the bands are then carefully pressed against the chest until they are moulded and accurately fit the chest. The instrument is then carefully removed and placed flat on a large piece of paper. An outline of the chest can then be obtained by running a pencil round the cirtometer as it lies on the paper in the same position as it occupied on the chest-wall.

The *spirometer* consists of a gasometer or metal tank inverted in water, properly poised and adjusted, into which the patient forcibly inspires through a tube. An index shows how many cubic inches of expired air have entered the apparatus.

4. **Percussion.**—Percussion may be direct or indirect. Direct or immediate percussion is usually performed with the finger tips on the clavicles or with whole flat of the hand (shielded by a fold of towel) on the front, back and sides of the chest. Indirect or mediate percussion is usually performed by laying the fingers of the left hand upon the chest and striking one of the left fingers with one or more of the finger tips of the right hand. By *percussion* sounds are elicited and the amount of resistance is felt. The intensity and pitch of the percussion note must first be learned by practice on a normal chest.

5. **Auscultation.**—The ear may be applied to the chest directly, with or without the intervention of a thin cloth, or a stethoscope may be employed. The objects of auscultation are to investigate sounds, namely:—the *respiratory* or *breath-sounds*; *râles* or *rhonchi* which are adventitious sounds; *friction sounds*; certain peculiar sounds, such as *metallic tinkling* and *amphoric echo*; *vocal resonance*, the sound produced during the act of speaking or crying; *tussive resonance*, or the sound elicited by the act of coughing.

6. The use of the *aspirator* or *exploratory trochar*.

ABNORMAL RESPIRATORY MOVEMENTS.

The respirations may be counted by watching the movements; or by applying the hand to the chest.

Increased frequency of respiration is brought about by any cause which interferes with the action of the lungs, or with the circulation of blood through the lungs. It is also noticed in fevers; in unhealthy states of the blood; and in certain nervous disorders, such as hysteria.

Abnormally slow breathing is often noticed in apoplexy and narcotic poisoning.

Deep and forced breathing is brought about by anything that interferes with the function of the lower part of the lungs, such as diseases in these organs themselves, accumulations in the pleura, enlarged liver, &c., by cardiac diseases which impede the circulation of the blood; by abnormal conditions of the blood itself, such as anæmia.

Shallow breathing may be associated with increased, normal or diminished frequency. The causes are painful chest affections, such as pleurisy; anything that extensively obstructs the functions of the lungs, such as capillary bronchitis; certain conditions of the central nervous system, for instance narcotic poisoning and trance.

The relation between the thoracic and abdominal movements of respiration is sometimes altered. In some cases the thoracic movements are in excess; in others the diaphragmatic or abdominal.

Local deficiency of expansion of the chest is generally due to phthisis or to localized pleuritic adhesions.

The so-called *Cheyne-Stokes' breathing* is sometimes observed, especially in certain diseases of the heart. At intervals respiration becomes gradually hurried and deeper up to a certain point, and then subsides in the same gradual manner, until at last there is cessation of breathing lasting from a quarter to three-quarters of a minute.

Vocal fremitus is investigated by applying the hand to the surface of the chest while the patient says 'ninety-nine' or counts or answers a question. Vocal fremitus is generally rather more marked on the right side than on the left. In disease the area of vocal fremitus may be increased owing to distension of the lungs from emphysema or hypertrophy; or it may be diminished, as in retraction or displacement of the lung.

The following causes lead to an *increase in the intensity of vocal fremitus*:—Increased vocal fremitus is an important sign of pneumonia, phthisis, and chronic pneumonia with dilated bronchi. *Vocal fremitus is diminished* when some imperfectly conducting material, such as fluid or air, intervenes between the lung and the chest-wall; when the lung is displaced by enlarged organs or morbid growths; when there is very dense and extensive consolidation of the lungs with obliteration of the bronchial tubes; and when the lungs are distended in marked emphysema.

CHANGES AFFECTING THE PERCUSSION SOUNDS.

The sound brought out by percussing over healthy lungs is termed *pulmonary* or *clear*. When percussing the chest with the view of obtaining evidence of disease the points to be noticed are:—(1) Whether the sounds are abnormal. (2) If there is any increase or decrease in the extent over which the normal pulmonary sound is heard. (3) If superficial and deep percussion yield different results.

More or less *dulness* on percussion may result from (1) thickness of the chest-walls; (2) fluid in the pleura; (3) consolidation, congestion or œdema of the lung; (4) displacement of lung by enlarged organs, new growths, fluid accumulation in the pericardium, aneurisms or abscesses; (5) collapse or compression of the lungs. The dull note elicited may be short, high-pitched, almost non-resonant. This is called the *hard wooden sound.* Or it may be *puttylike* and absolutely non-resonant.

The *crack-pot sound* is similar to that produced by clasping the hands loosely together, and striking the back of one of them over the knee, so as to drive out the enclosed air. It is due to the sudden expulsion of air from a cavity through a small opening. It is commonly found in healthy children and also over large cavities of the lung.

Hyper-resonant percussion sound is obtained in pneumothorax and in emphysema.

Scodiac resonance is a peculiar form of hyper-resonance heard in pneumonia over the part of the lung which lies next to the consolidated portion.

CHANGES IN THE BREATH-SOUNDS DUE TO DISEASE.

The breath-sounds may be *abnormally weak* or even *absent* over a portion of the chest. On the other hand when one lung, or any portion of one or both lungs, is called upon to do extra work, the sounds may be *puerile*, being increased in intensity, the expiratory portion becoming unusually distinct.

In nervous persons and in certain chest and lung affections the breath-sounds may become *jerky* or *wavy*, so as sometimes to have a *cogged wheel rhythm.* A very important change in the rhythm of the breath-sounds is a *prolongation of the expiratory sound.*

The student should not allow his mind to be confused by the large number of names that have been used by various medical writers trained in different countries and in different schools. These exist practically in six different forms of breath-sound, and although each kind, when heard in a typical form is characteristic, yet they will all be found to run insensibly into one another, so that it is possible to increase the vocabulary of auscultation indefinitely.

The six best recognized types of breath-sounds are (1) normal, (2) senile, (3) puerile, (4) broncho-vesicular, (5) bronchial, (6) amphoric.

It will be remembered that in normal breathing the inspiratory sound is much longer than the expiratory. In senile breathing the expiratory sound is practically absent and the inspiratory is very faint and often difficult to hear. In puerile the expiratory almost equals in length the inspiratory and both are very loud. Bronchial breathing is the sound normally heard in the interscapular region over the bifurcation of the trachea over the bronchi and also about the upper end of the sternum. Bronchial breathing is divided into three varieties named tubular, bronchial and cavernous according as the sounds heard are high, medium or low pitched.

Bronchial breathing heard over a part of the chest, where it does not normally exist, is noticed in pneumonic consolidation, over cavities in lung (sometimes), over dilated bronchi and when a solid mass of lung or a tumour intervenes between the surface and a large bronchus.

Amphoric breathing is similar to the sound produced by blowing across the mouth of a large jar with a narrow neck: it is of a hollow blowing and booming character. For its production a large smooth cavity is necessary.

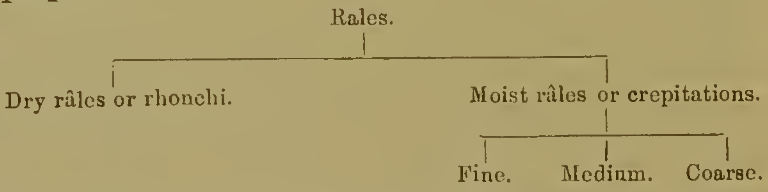
All the morbid breath-sound above mentioned are often heard more distinctly when the patient takes a long breath. Sometimes a sharp cough enables them to be heard when they were inaudible before. This is due to the displacement of obstructing secretion and sputa or the discharge of fluid from a cavity allowing the air to enter.

RÂLES OR RHONCHI.

The rubbing of clothes, the contraction of the muscles of the chest-walls, sub-cutaneous œdema or emphysema, and hairs on the chest produce sounds beneath a stethoscope, which the student must always be careful to differentiate from râles or rhonchi.

ADVENTITIOUS SOUNDS.

Under this term are included the various sounds which may be superadded to the breath-sounds proper and may even in some cases entirely mask and replace them. They may be produced in any portion of the pulmonary system from the bronchi downwards to the pleura. Attempts have been made to classify these sounds in many different ways, but the following simple classification is quite sufficient for all practical purposes :—



Dry râles or rhonchi are sounds of whistling, sonorous, cooing, or squeaking character produced in the bronchial tubes and are called sonorous or sibilant according to the pitch of the note produced.

Rhonchi are produced by (1) inequalities in the lining of the bronchi produced by disease; (2) the presence of mucus lying in the bronchial tubes but not sufficiently fluid to bubble with the passage of the respired air; (3) by spasmodic contraction of the muscular coat of the bronchi.

Rhonchi are heard in congestion of the lungs in bronchitis and asthma.

Moist râles or crepitations are produced in the bronchi, in the air vesicles, and in pulmonary cavities. They denote the presence of air mixed with fluid or viscid secretion in these positions and are due to either air actually bubbling through fluid or to the separation of the bronchial and vesicular walls from one another and from their contents during the passage of the respired air.

Fine crepitations resemble the sound that is produced by rubbing a lock of one's hair between the finger and thumb, by the bursting of minute bubbles of air as in an opened soda water bottle, whilst coarse crepitation may be bubbling, gurgling or even tinkling. They are nearly always heard during inspiration.

Fine crepitations are heard in acute pneumonia, congestion of the lungs, œdema of lungs. Subcrepitant râle is a name sometimes given to medium crepitations.

Coarse crepitations are heard in cavities in the lung, and in dilated bronchi (bronchiectasis). Tinkling or metallic coarse crepitations are sometimes heard in large pulmonary cavities and in hydro-pneumothorax.

Friction is a sound heard when the pleural surfaces are roughened and rub together; it is said to resemble the noise produced by rubbing together two pieces of wash leather, but must be heard to be learned. It cannot be made to alter in character by coughing.

FRICTION SOUNDS.

Friction sounds may be rubbing, creaking, crepitant, crackling, or clicking in character. They are always superficial. In some cases friction sounds resemble crepitations, but are distinguished from these by being *unaffected by cough.* Friction is most common towards the lower part of the chest, especially below the angle of the scapula, or in the infra-axillary region. It is often very limited in extent.

VOCAL RESONANCE.

Vocal resonance is *more or less weakened or lost* over a variable extent of surface when air or fluid in the pleura separates the lung from the chest-wall; when there is very extensive or dense consolidation of the lung; when the lung is displaced by tumours or enlarged organs; when the lung is collapsed; and in many cases of emphysema.

Vocal resonance may be *increased in intensity* or *clearness.* In *bronchophony*, which is noticed in health in the interscapular regions, there is an increase in the clearness of the vocal resonance, which is generally intensified as well Bronchophony may be noticed when there is lung consolidation, provided it is not excessive. Small cavities in the lung with consolidation around may also give rise to bronchophony.

In *whispering pectoriloquy* the faintest whisper is clearly heard. It is best heard in cases of pneumothorax, but may be associated with phthisical cavities.

Ægophony is the term applied to vocal resonance of a peculiar *bleating* or *nasal character* heard in some cases of pleuritic effusion at the upper level of the fluid.

Metallic tinkling resembles the sound produced by dropping a shot into a large metal basin. It is heard in connection with large air-containing cavities or spaces in which there is little fluid.

In some cases of hydro-or pyo-pneumothorax, and more rarely in connection with large phthisical cavities, a *splashing sound* is heard on shaking the patient. *Succussion* is a mode of examination seldom required and shows the presence of both air and fluid in a large space.

CHAPTER VI.

EXAMINATION OF THE CIRCULATORY SYSTEM.

THE HEART.

1. In examining the heart for disease, the student should acquire the habit of always examining the patient systematically.

The detail of the examination undertaken should be conducted in the following manner :—

First inspection, then palpation, then percussion and finally auscultation. The pulse should also be examined at the same time. The subjective phenomena connected with heart disease are, breathlessness, faintness, giddiness and signs of weakness and irregular action of the heart, while palpitation and pain in the cardiac region are more often associated with biliousness and nervousness than with actual heart disease. Angina-pectoris is, however, associated with some forms of heart disease, but is comparatively rare. Cardiac breathlessness differs from breathlessness the result of lung disease, in that the patient loses all breathlessness when at rest, and only becomes distressed on movement or exercise.

2. Before considering what we may learn of heart disease from inspection, the student should have, in his mind, a clear idea of what is to be gathered by inspection in a human body during health. Ordinarily, in the human chest, there is

very little to be seen, and consequently if pulsations of veins, or pulsations between the ribs, or any other abnormal sign, is noticed, you may be certain that something abnormal is occurring. The 'apex-beat' of the normal heart is seen in the healthy male, one and a half inches below and one inch to the sternal side of the left nipple, in the fifth inter-costal space. Its relation to the nipple in the female is so variable as to be useless. Two and a half inches from the left border of the sternum in the fifth inter-costal space is the place to expect to find it in full-grown women.

The force of the 'apex-beat' depending, as it does, on the force of the cardiac contraction, will vary both in health and in disease. In health, except during and after violent exercise, nothing is seen but a slight heaving at the spot indicated above.

In disease we should note, if there is any undue pulsation in the carotid arteries, or in the tracheal fossa, and whether the veins of the neck are enlarged. It should be noted also whether the pulsation is synchronous with the systole or diastole. A simple undulation in the jugular vein on the right side is a sign of congestion of the right auricle, and possibly of the right ventricle.

Visible venous pulsation is therefore invariably a sign of considerable importance in the diagnosis of heart disease, but visible arterial pulsation is occasionally found in the normal condition, and is sometimes highly marked when the vessels are very atheromatous and tortous as they frequently are in advanced old age. In very marked enlargement of the heart, in thin persons especially, pulsations may be seen between the second, third, fourth and fifth ribs immediately to the left of the sternum.

Bulgings of the chest dependent upon aneurisms of the arch of the aorta. Invariably commence above the fourth rib, and appear as local tumours. Hypertrophy of the heart pericardial effusion and mediastinal tumours cause local bulging but almost always below the level of the fourth rib.

Depressions of the cardiac region are much more rare than elevation and are, as a rule, the result of previous pericarditis with an adherent pericardium.

In very thin persons, however, there is sometimes seen, considerable depression of the chest between the ribs. This is the result of the atmospheric pressure depressing the inter-costal spaces at the moment of the cardiac systolic contraction. It does not mean that the patient is suffering from adherent pericardium; but is most markedly visible, when there is some hypertrophy of the heart.

The apex-beat will be moved slightly to the left when the patient is made to lie upon the left side. The apex-beat will be absent or feeble when the heart beats are feeble: and also when the apex of the heart can no longer beat against the chest wall, on account of effusion of fluid in the pericardium. Very marked tympanites and ascites and other forms of abdominal distension will occasionally displace the apex-beat upwards. The apex will occasionally be found to the right of the sternum when there is much effusion into the left pleural cavity, and the heart is pushed far to the right side of the chest.

When the heart is greatly enlarged, or when it is pushed down by aneurism of the aorta, the apex-beat will be displaced downwards and outwards, sometimes several inches. Pulsation may also be noticed below the ensiform cartilage in some forms of heart disease, and generally in the case of enlargements of the right side of the heart.

Pulsations of the liver are usually the result of the heart beating on the surface of the liver which is only separated from the pericardium by the diaphragm. But in some forms of advanced heart disease, true expansile pulsation will be found in the liver itself. In some rare cases a pulsatory movement is also conveyed to the epigastric region through the movement of the heart's apex during the ventricular systole pulling upwards an adherent pericardium, diaphragm and liver. But as a rule, when the ventricular systole displaces the diaphragm and liver, it does so by pressing them downwards.

PALPATION.

Palpation confirms the information obtained by inspection, and adds something to it. On placing the hand over the cardiac area in many persons, with thin chest walls, the apex can immediately be made out. But in fat persons with a feebly-beating heart it is sometimes difficult to make out the exact position of the apex-beat. When the force of the apex-beat is increased, it is an indication of hypertrophy, but diminution of that force is by no means to be regarded as a certain indication of cardiac debility. Pericardial effusion will often completely annihilate the apex-beat, and so will great obesity. Visible pulsation chiefly to the left of the cardiac area, with depression of the apex-beat indicates dilatation and hypertrophy of the left ventricle, while pulsation beneath the lower part of the sternum with disappearance of the apex-beat, reveals dilatation with or without hypertrophy. When the left lung is from any cause retracted from the base of the heart, pulsation may be felt between the second and third ribs close to the sternum. This pulsation is communicated from the pulmonary artery; sometimes even the click of the closure of the semilunar valves can be actually felt.

The points to be noted in palpation are:—(1) Position of any perceptible pulsation; (2) its extent and force; (3) its rhythm (*i.e.*, whether systolic or diastolic, and whether regular or irregular).

A thrill can often be felt at the apex-beat in cases of cardiac disease, more especially in mitral stenosis and sometimes in early pericarditis, before effusion has taken place.

PERCUSSION.

The heart as compared with the lungs may be described as a solid body lying in the centre of the chest. When we percuss out the chest, it will be easily observed that a certain part of its surface will give a dull note on percussion, as compared with the resonant note yielded by those portions beneath which lung tissue is situated. Beneath this dull area the heart is situated. The greater portion of the heart is separated from the chest wall by overlapping lung, and therefore it is only the small uncovered part consisting mostly of the right ventricle, which in health gives on percussion an absolutely dull note. This area is called the area of *absolute cardiac dullness* and is easily mapped out. Its right border extends along the right margin of the sternum (or along the mid-sternal line), from the level of the fourth to that of the sixth costal cartilage. The left border of this dull area is an irregular line, stretching from the upper end of the right border to the apex-beat. The lower border of this dullness cannot be differentiated, because the dullness here merges into the dullness of the liver, but it may be approximately mapped out by drawing a line from the apex-beat to the upper limit of absolute hepatic dullness on the right side. The superficial extent of this dullness does not vary much with the respiratory movements. Indeed there is but little change in the dull area whether the chest is being held in a condition of deep inspiration or of deep expiration. Conditions of the margins of the lungs such as occur in emphysema have an important influence on the size of this area of cardiac dullness. A good and general rule is that the upper limit of the deep *or relative* cardiac dullness lies along the lower border of the third left rib, and that the left edge of this dullness extends about one inch to the left and parallel with the absolute cardiac dullness, before mapped out.

Cardiac disease more often leads to enlargement than to atrophy of the heart, and therefore it will be more common to find enlargement of the area of relative cardiac dullness, than to find diminution of that area. Disease of the lungs, however, will be likely to cause apparent diminution of the absolute cardiac dullness. Though from the formation and position of the heart it is obvious, that we can and may percuss out the whole of the cardiac dullness, it is generally unnecessary to do so.

It is only of importance for us to ascertain its greatest extent, vertically, and transversely. Increase of vertical dullness, rarely indicates any alteration in the size of the heart itself, but is usually due to effusion into the pericardium or to aneurism of the aorta. Increase of transverse dullness indicates hypertrophy or pericardial effusion.

Contraction due to pleurisy, or to deformity of the chest wall, is indicated by transference of the normal dullness upwards or downwards, to the right or to the left. The right auricle is that part of the heart which extends farthest to the right, and being very thin and easily dilatable, any obstacle to the circulation within the heart will cause it to expand. Hence increase of the transverse dullness, at the level of the fourth rib is due to auricular distension and not to increase in size of the right ventricle and comes to be an important indication of some obstacle to the cardiac circulation. Increase of the dullness above the third rib indicates, as a rule, pericardial effusion. Increase of transverse dullness at the level of the fourth rib indicates obstruction to the circulation.

Absence of diminution of cardiac dullness is in very rare cases caused by the presence of air in the pericardium, but infinitely more frequently, by increase of the area of pulmonary resonance, due to emphysema of the lungs.

AUSCULTATION.

The student should remember that auscultation reveals less about the heart than the other methods of examination.

Auscultation should always come last, in the observation of the physical factors, which lead to the diagnosis of heart disease. The varying and vanishing of cardiac murmurs cause less reliance to be placed upon them, than on the more definite physical facts elicited by inspection, palpation, percussion and examination of the pulse.

Many murmurs occur in the heart, which have no connection with organic heart disease. When the stethoscope is applied to the chest over the healthy heart, two sounds are heard which have been likened to the sounds Lūb and Dŭpp. The first of these two sounds is the longer, the second is the sharper and shorter. The first is due most probably, partly to the muscular sound produced by the ventricular contraction, and partly to the vibration of the chordæ tendiniæ, as they close the mitral and tri-cuspid valves. The second sound is caused by the simultaneous snapping and closing of the aortic and pulmonary semilunar valves. When the valves of the heart are diseased or deformed in such a way that they no longer close completely, or that they offer an obstruction to the onward passage of the blood from one cavity of the heart into the next, the heart sounds cease to be the plain Lūb and Dŭpp. They then either become converted completely into various murmurs, which are swishing sounds of different degrees of intensity, or these murmurs are superadded to the sounds themselves, or again they sometimes occupy the space of time which should separate the normal heart sounds and during which time there should be complete silence. Now, inasmuch as the left ventricle is nearest to the wall of the chest at and around the apex-beat, the sounds connected with the left ventricle and mitral valve will be most distinctly heard at and around the position of the apex. Again since the aortic and pulmonary valves lie behind the junction of the third ribs with the sternum, abnormal or other sounds, connected with these valves, will probably be heard most distinctly in that neighbourhood. Since also the right ventricle lies immediately behind the junction of the fifth ribs with the sternum and behind the base of the ensiform cartilage, murmurs or other abnormal sounds connected with the right ventricle and tri-cuspid valve, will be heard most distinctly about that region.

Occasionally the second sound of the heart, due as it is to the snapping and rapid closure of two sets of valves, becomes in disease a double sound, on account of the non-simultaneous closure of the aortic and pulmonary semilunar valves. Whether it is possible for the first sound of the heart to be in similar manner divided into two, and thus to form a double first sound by asynchronous action of the two ventricles has not yet been fully decided. Although disease of the valves of the heart leading to their shrinkage and to roughening of their surfaces will produce murmurs, it is well to remember that, as a rule, the loudness of the murmur does not depend upon the amount of the shrinkage or stenosis of the valve, for a small opening will often produce a louder and higher note than a large and more serious deficiency of the valve. In pericarditis, the roughening of the two surfaces of the pericardium, will cause sounds to be heard over the cardiac area which are very similar to those produced by valvular disease.

In cases of anæmia sounds are produced which are indistinguishable, by the sound alone, from the murmurs of cardiac organic disease. Although it is usual, and best as a rule to examine persons suspected of heart disease in the recumbent position, it is sometimes necessary in the slighter forms of valvular lesion, to make the heart sounds louder by causing the patient to walk, or even run quickly up and down the room several times. This, however, must never be attempted, when, breathlessness, blueness of the lips or swelling of the feet and legs, proclaim to the observer that the case, if a case of heart disease, is one in which the affection is in an advanced stage. The first sound will be found, as a rule, to be *intensified* in excitement, in fever, after exercise and when hypertrophy of the ventricle is present, as all these cause the muscular action of the heart and consequently the loudness of the sound to be increased. Intensification or accentuation of the second sound will arise from any cause, which raises the pressure inside the aorta or the pulmonary artery and thereby causes the semilunar valves to shut more sharply than usual. The sounds of the heart will be *enfeebled* when the heart is enfeebled as in anæmia, old age, with prolonged fever, with dilatation of the heart and with fatty degeneration of the heart muscle ; also with much pericardial effusion and advanced emphysema of the lungs.

Although murmurs occurring within the heart, are best heard at the points above mentioned, it is of importance diagnosistically, to remember that murmurs due to mitral regurgitation are heard, not only around the apex, but also right round the left side of the chest at the level of the apex often as far backwards as the spine. Murmurs due to mitral obstruction are much more localised and are generally only to be heard over a small area (*viz.*, over the left auricle).

The murmurs due to aortic regurgitation are heard down the length of the sternum to the hypogastric region and if sufficiently loud over almost the entire cardiac area. Murmurs due to aortic stenosis are propagated upwards into the great arteries of the neck and if sufficiently loud can sometimes be traced along the brachial and femoral arteries. Murmurs due to disease of the tri-cuspid valve, are best heard over the lower end of the sternum, and at the apex. Murmurs which occur during the ventricular systole of the heart, that is, murmurs due to (1) mitral regurgitation, (2) tri-cuspid regurgitation, (3) aortic obstruction, and (4) pulmonary obstruction, are termed systolic murmurs. Murmurs which occur during the ventricular diastole, *viz.*, those of (1) aortic regurgitation, (2) pulmonary regurgitation, and mitral stenosis, and tri-cuspid stenosis are called diastolic murmurs. But since murmurs connected with mitral obstruction must necessarily take place, whilst the auricle is emptying itself into the ventricle just before the ventricular systole, the name presystolic has been given to such murmurs. Valvular disease of the left side of the heart is far more common than valvular disease of the right side of the heart. The tri-cuspid valve being a very easily dilatable valve almost always becomes incompetent as a secondary complication of mitral disease, since the mitral regurgitation or obstruction has caused the lungs and the whole pulmonary circuit to become engorged. Primary disease of the right side of the heart is rare. Although aortic regurgitation is often associated with aortic obstruction, yet an aortic obstruction without regurgitation is distinctly rare.

If the student will remember exactly what is occurring during the systole, and during the diastole of the heart he will have small difficulty in understanding the exact time at which endocardial murmurs due to the various forms of valvular lesion, may be expected to occur. Systolic murmurs must be due to some abnormal disturbance in the column of blood leaving each of the ventricles during their contraction and will therefore be caused by stenosis of the aorta and pulmonary arteries (stenosis of the aortic valve is very much more common than stenosis of the pulmonary valve). It will also be caused by the abnormal systolic backward flow of blood into the auricles when there is incompetence of the mitral or tri-cuspid valves.

Diastolic murmurs, on the other hand, will occur as the result of incompetence of the aortic and pulmonary valves (aortic incompetence is common, pulmonary incompetence very rare) and also from stenosis of the mitral and tri-cuspid valves. These facts will be plain to the student it he will bear in mind, that the diastole is the time when the auricles are forcing their contents into the ventricles, and when the semilunar valves in health remain firmly shut, to prevent backflow into the ventricles from the aorta and pulmonary artery. The word *presystolic* is generally used to denote the diastolic murmur that is heard just before the ventricular systole in cases of mitral or tri-cuspid stenosis. It is to be remembered that the left side of the heart is much more subject to disease than the right, but that the tri-cuspid valve often becomes incompetent, as a secondary change in advanced cases of valvular disease of the left side of the heart.

Diseases of the aortic, mitral and tri-cuspid valves very commonly cause incompetance and stenosis to occur at one and the same time.

DIFFERENTIAL DIAGNOSIS OF VALVULAR DISEASES OF THE HEART.

Mitral Disease.

1. **Mitral obstruction** is usually caused by rheumatic endocarditis, and is almost always accompanied by a thrill at apex-beat, and produces hypertrophy and dilatation of the left auricle and consequent increase of the cardiac dulness upwards. The apex-beat is displaced slightly downwards. On auscultation a presystolic murmur is heard. The pulse is likely to be small and irregular.

2. **Mitral regurgitation** is usually the result of rheumatic endocarditis, produces hypertrophy, and later on in the disease, dilatation of the left ventricle with hypertrophy and dilatation of the left auricle. The apex-beat is displaced outwards and somewhat downwards. On auscultation, a systolic murmur is best heard at and round the apex, and is conducted round the side into the axilla. The pulse is weak, irregular and often intermittent.

The second sound at the pulmonary area almost always intensified on account of the secondary pulmonary congestion.

Aortic Disease.

1. **Aortic obstruction** is caused by atheroma of the aortic valves and by endocarditis. It produces hypertrophy

of the left ventricle with displacement of the apex-beat downwards. The apex-beat is usually heaving and forcible. On auscultation there is heard a systolic murmur traceable from the aortic area upwards and to the right, and often conducted into the great vessels of the neck. The pulse is small and compressible.

2. **Aortic regurgitation** is also the result both of atheroma and of endocarditis and is very commonly associated with aortic obstruction. The apex-beat is usually forcible. The heart is enlarged and increased in length and has been called the 'cucumber' heart. The apex-beat being displaced markedly downwards and outwards. On auscultation a loud diastolic murmur is usually heard over an area extending from the level of second rib to the apex and down the whole length of the sternum, but the loudness of the murmur is often in inverse proportion to the amount of incompetence. The pulse is sudden, jerky, collapsable, known by the name of 'water-hammer,' or Corrigan's pulse, and is often very dicrotic.

Tri-cuspid obstruction is generally due to a congenital malformation but sometimes to endocarditis, and it is principally characterised by the enlargement of the area of cardiac dullness to the right of the sternum opposite to the third, fourth, fifth costal cartilages, with enlargement of the great veins of the neck and marked pulmonary congestion. There is a presystolic murmur to be heard at the base and along the right border of the sternum.

Tri-cuspid regurgitation is usually secondary to mitral disease, but occasionally primary and due to endocarditis. It is characterised by the absence or great feebleness of the apex-beat, by systolic beating in the epigastrium, by increased dullness at the level of the fourth rib, by a systolic murmur at the lower end of the sternum and at the junction of the fourth, fifth, and sixth ribs on the right side with the sternum, by pulsation of the jugular veins and other veins at the base of the neck and sometimes by hepatic pulsation. Pulmonary valve disease is so rare that a description is unnecessary here. When pulmonary obstruction exists, it is practically always the result of congenital constriction and malformation of the pulmonary orifice. It leads to hypertrophy of the right ventricle, is accompanied by a systolic murmur, localised at the junction of the third left rib with the sternum and has no effect upon the pulse.

EXAMINATION OF THE ARTERIES.

Aneurism.—Only aneurisms within the chest or abdomen come specially under the notice of the physician. The most important symptoms are those caused by *pressure*. An aneurism may cause displacement of the heart, the trachea, &c. It may press upon the air tubes, œsophagus, thoracic duct and stretch the vagus or recurrent laryngeal nerves. It may compress and so interfere with the functions of the lungs and other organs. *Cough* is not uncommon in thoracic aneurism. It may set up inflammation, suppuration and destruction of tissues. Abnormal *local sensations* are usually present, such as pain, heat, fulness and weight, or throbbing. Tenderness or cutaneous hyperæsthesia is common. Enlargement of veins from pressure is often noticed. There may be *local bulging* or a distinct *tumour*, which pulsates. In some cases a thrill is felt. An aneurism usually gives rise to more or less *dullness on percussion*, usually above the level of left fourth rib, extending up towards the neck. On auscultation a rough *murmur* may be heard, usually systolic. The radial pulse often affords important signs in thoracic aneurism. It may be delayed on one side; or it may differ in fulness and force on the two sides, being sometimes completely absent on one side.

Obstruction of an artery will cause symptoms dependent upon the want of a proper supply of arterial blood in the parts to which the obstructed vessel normally conveys it. The symptoms will vary with the degree and rapidity of obstruction. There will be more or less *loss of function and vitality* in the parts deprived of blood.

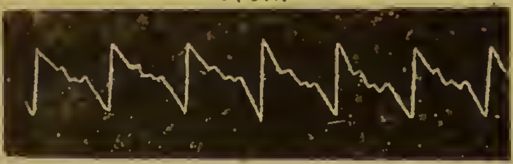
Excessive pulsation of arteries may be due to—(*a*) excited action of the heart; (*b*) hypertrophy of the left ventricle; (*c*) an atheromatous condition of the vessels.

Pressure over an artery with the stethescope will produce a murmur. This is well observed in connection with the third part of the subclavian artery. Pressure by a tumour, enlarged glands, or fibrous thickening and adhesions may cause an arterial murmur. One of the best examples of this is the subclavian murmur heard above or below the left clavicle in some cases of phthisis.

The best way to ascertain the condition of the arterial system generally is to examine the brachial artery just above the elbow. If the vessels are atheromatous or calcified the brachial artery, on bending the elbow, is distinctly visible and tortuous, and it feels hard, incompressible, and rolls like a cord under the finger.

A sphygmographic tracing is generally taken over the radial artery. The tracing is made up of a series of *curves* or *pulsations*, each of which corresponds with a completed heart beat (*see* fig. 1). Each typical curve consists of at *systolic* and *diastolic* part, corresponding respectively to the period of contraction and dilatation of the ventricle; or it may be divided into:—(*a*) Line of ascent, (*b*) Summit, (*c*) Line of descent, in which may be observed two or some times three secondary waves with intervening notches, named, *first* or *distension wave; second* or *great wave*, and *third wave*, which lies between the other two, but is usually absent.

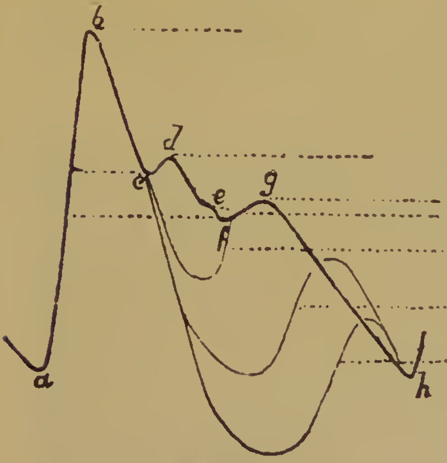
FIG. 1.



Sphygmographic Tracing—'ROBERTS.'

The *line of ascent*, *summit-wave*, or *percussion-impulse* (*a* to *b*, fig. 2) is produced by the more or less sudden contraction of the left ventricle. Then the arterial walls partially collapse, which is indicated by the first part of the line of descent, ending in the first notch (*b* to *c*). A wave of blood next passes out of the heart into the aorta, and this gives rise to the *first secondary wave* or *wave of distension* (*c* to *d*.) Then there is a reflux of blood towards the heart, by which the aortic valves are closed, which corresponds to the portion of the line of descent from *d* to *f*, ending in the great or aortic notch *f*. During this reflux a vibration may occur, causing the *third secondary wave* (*e*). The aortic valves are then suddenly closed by the pressure of the reflux current of blood, and this accounts for the *great secondary wave* (*f* to *g*). Finally, the blood flows onward and, as a result, the line of descent is continued from *g* to *h*.

FIG. 2.



Enlarged sphygmographic Curve—'ROBERTS.'

The systolic portion of the curve extends from *a* to *f*; the remainder of the curve (*f* to *h*) corresponds to the diastole.

The examination of the arteries and veins should be conducted in the same systematic way as that in which the student has already learnt to examine both the respiratory system and the heart.

ARTERIES.

1. **Inspection.**—In health the pulsation of the arteries of the body is little visible, except in case of great excitement or after violent exercise. In disease, however, those arteries which are nearer the surface of the body such as the carotid temporal, and even the abdominal aorta can be seen to pulsate. This condition of pulsation is also marked in fever, and in hypertrophy of the left side of the heart. It is more visible in persons with atheromatous arteries, than in healthy persons.

2. **Palpation.**—More can be learnt by palpation, or what is commonly called 'feeling of the pulse' than by any other method of examination. The radial pulse at the wrist is the situation most commonly taken for palpation and for feeling the pulse. But the student should learn to feel the pulse not only at the wrist but in the temporal region in the carotids and in the tibial arteries. The radial pulse should be similar in each arm, but in certain diseases of the great vessels in and about the chest and root of the neck, variation of one side will be of great diagnostic importance. It should also be remembered that the radial artery is not uncommonly abnormally situated or absent.

The pulse should be examined for (1) frequency, (2) rhythm, (3) character, and (4) condition. In healthy adult males the pulse averages about 70 beats per minute. It is considerably faster in most women, and very much faster in all children. Exercise, fever, excitement, and some medicines, produce an increase in frequency. The recumbent posture, weakness from prolonged disease, and some drugs produce slowing of the pulse.

3. **Rhythm.**—The pulsations felt at the wrist and in every artery in the body are normally separated by regular intervals of time, but in disease they may be separated by unequal intervals and the force of the different beats may vary very greatly. The pulse may alternate between small and large beats, may be double (dicrotic), may be intermittent, or may be so fast as to be uncountable.

4. **Character.**—The character of the pulse may be felt, and it should be noticed whether the pulse gives the sensation of normal elastic resistance of a healthy artery, whether the tension is higher or lower than normal, or whether the volume of blood flow in the artery has increased or decreased. When the pulse has a very quick stroke, and then falls away, so that the artery seems to become empty between each stroke it goes by the name of 'Corrigan's pulse.'

5. **Percussion.**—Except in the case of aneurisms of the aorta, and of the larger arteries nothing is to be learnt from percussion. Something, however, may be gained by auscultation.

A murmur very similar to the murmurs heard in valvular heart disease, can generally be produced in an artery, by pressing upon it with a stethescope. In disease, murmurs are conducted from the heart especially from the aortic valves up into arteries at the root of the neck, and in some unusually loud cardiac murmurs, the sounds can be heard in the femoral, and even in the radial arteries. In aneurisms a peculiar form of murmur and swashing sound can usually be made out.

CHAPTER VII.

CLINICAL EXAMINATION OF DISEASES OF THE LYMPHATIC SYSTEM.

The following symptoms are met with in diseases of the lymphatic system, viz., *redness*, *swelling*, *pain*, *suppuration*, *fever*, *discharges of lymph from various parts of the body, and the presence of embryo filariæ in the blood and mature filariæ in the lymphatics.*

Redness running in lines or streaks indicates *inflammation of the superficial lymph* vessels; and in such cases there may also be a diffused redness. *Inflammation of the deep vessels* may also cause redness of the surface.

Swelling.—Slight localised swellings sometimes accompany *inflammation of the superficial vessels* and are situated in the line of the main vessels. The latter may sometimes be felt like knotted cords beneath the skin. When *the deep trunks* are involved, there are indurations of variable extent, but fixed, and giving the idea of œdema rather than inflammation.

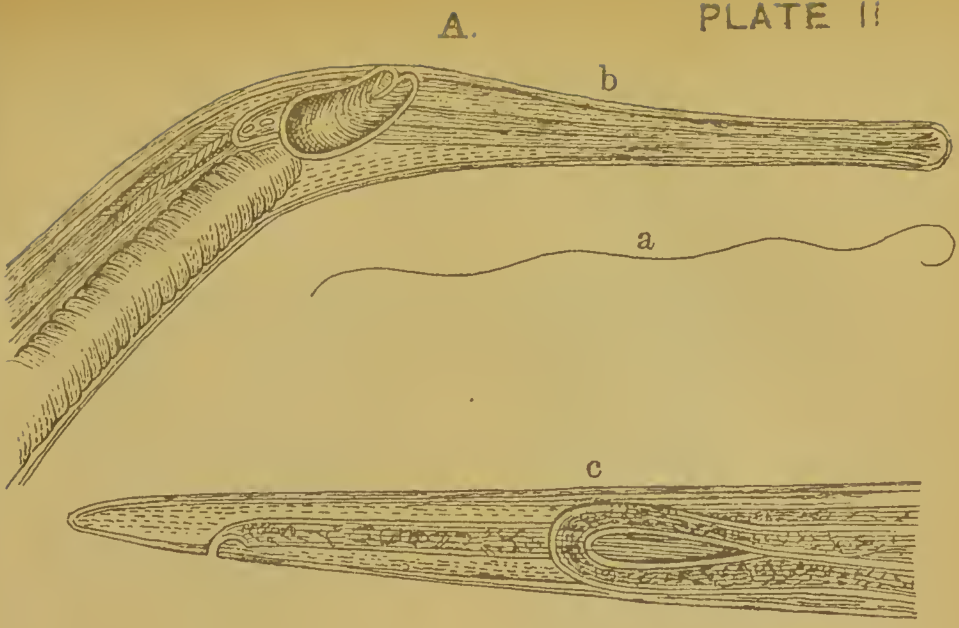
When complete obstruction of the lymphatic circulation has taken place, there is general œdematous swelling of the part drained by the affected lymphatics. This lymphatic œdema is distinguished from venous œdema by the greater firmness and the brawny condition of the part. Such results are seen in obstruction due to tight bandaging, or to the presence of filariæ in the lymphatic channels.

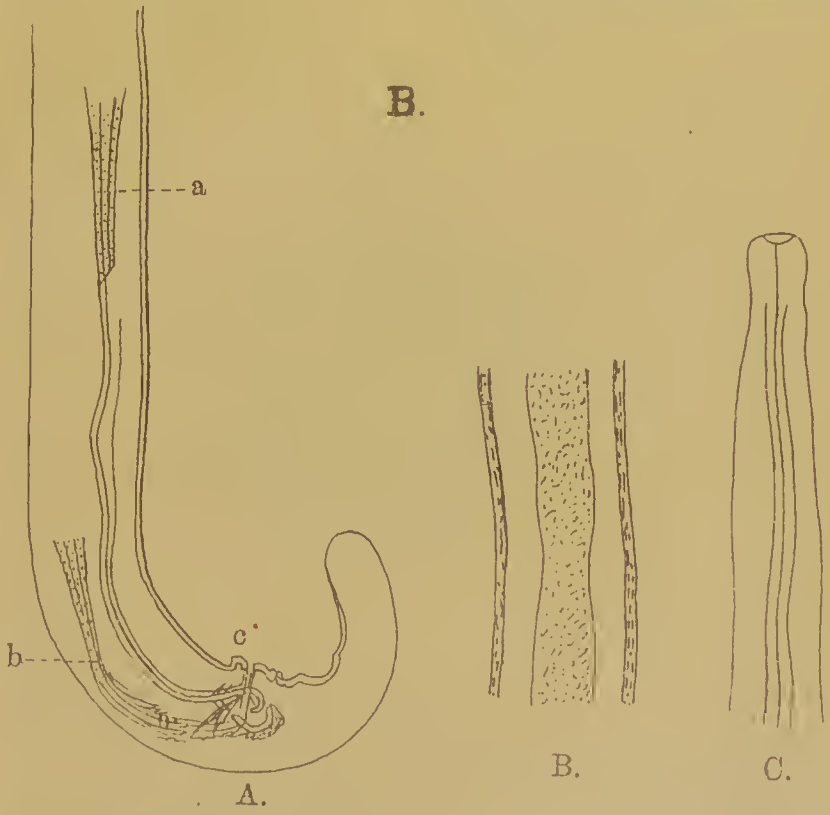
When attacks of obstruction of the lymphatic circulation recur frequently, or when the obstruction becomes permanent, the swelling of the affected part gradually becomes more and more solid, and finally the skin and subcutaneous tissue become enormously thickened and of leathery consistence, and give rise to great deformity of the part. The skin in such cases is often thrown into large folds and in places where the corium is firmly blended with the deep inelastic fascia, as in the palms of the hands, soles of the feet, groins, sides of the perinæum, ankles and wrists, there is no swelling. The skin loses its smoothness and assumes a warty appearance, and there may be a tendency to desquamation or an icthyotic condition. Cracks, fissures and ulcers often form, especially between the folds of the skin. Sometimes the surface of the swelling presents an eczematouslike condition, and pours forth a watery discharge. Such swellings are seen in cases of *elephantiasis.*

When the obstruction to the flow of lymph, though permanent, is only partial, swellings of a different nature are seen. In this case the swelling is more or less circumscribed and of irregular outline, and when manipulated feels somewhat like a bag of worms. The swelling, however, is very soft, and if pressure is exerted, it disappears, re-appearing when the pressure is withdrawn. In many cases these tumours are only seen when the patient assumes the erect posture, disappearing when he lies down. When they occur in the inguinal and femoral regions, they may be mistaken for herniæ. A hernia, however, does not descend when the patient assumes the erect posture if a finger be kept in the ring; whereas these tumours do descend. Moreover there is absence of gurgling on reduction or impulse on coughing. Such tumours constitute the disease termed *lymphangiectasis.*

In partial obstruction of the lymphatics of the scrotum, the skin is slightly thickened and becomes remarkably soft and corrugated and imparts a sensation of silkiness to the

PLATE II





A—Filaria Bancrofti. a, Female (nat. size); b, head and neck (× 55 diam.); c, tail. (Cobbold.)

B—A, Tail end of male; a, long spicule; b, short spicule; c, cloaca. B, showing constriction, marking union of œsophagus and intestinal canal. C, head of male. (*Brit. Med. Journal*, April 21, 1894.)

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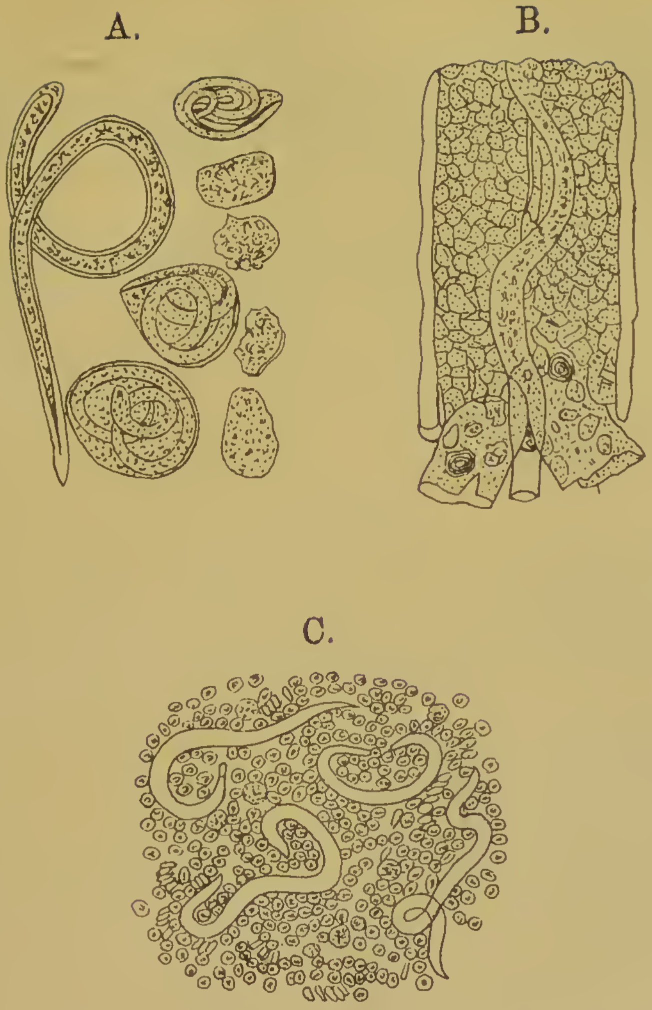
PLATE III



A - Ova and embryos of the filaria × 300.

B — A portion of the mature female showing uterine tubules filled with ova in various stages of development ; also the intestinal tube × 100. (After Lewis.)

C — Embryonic filariæ in blood. The red discs are somewhat shrunken; also the sheath of the embryo. (Treves' *System of Surgery.*)

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fingers. The surface is covered with vesicular-like elevations, which vary in size from that of a pin's head to that of a pea. Besides these vesicular-like elevations, bunches of varicose and turgid lymphatic vessels are often seen projecting the skin at various points. This disease is termed *lymph scrotum.*

The lymphatic glands become swollen as a result of inflammation (*lymphadenitis*) arising from any cause, and when the irritation is of long standing, they are not only enlarged, but also extremely hard and indurated. In some cases of obstruction to the flow of lymph, the glands assume the form of the soft collapsable swellings already described.

Pain and tenderness are met with when the lymph channels or lymph glands are inflamed.

Suppuration.—Abscess formation is not uncommon in tissues in which the lymphatic channels have become permanently blocked. Small abscesses sometimes form along the course of the main lymphatics of a limb, and when these abscesses are opened, dead filariæ, or portions of such, are found amongst the contents.

Fever.—Sudden attacks of fever are of frequent occurrence in persons who suffer from obstruction of the lymphatic circulation in some part of the body. These attacks are preceded by pain and tenderness of the lymphatic glands of the part, and are often ushered in by rigors, vomiting and pain in the loins. The fever lasts for three or four days and is accompanied by the signs of inflammation in the affected area.

Discharges of lymph or chylous fluid.—In many cases of permanent partial obstruction of the lymphatics periodical discharges of lymph occur from the surface of the affected area. These discharges of lymph are accompanied usually by signs of local inflammation and by fever, and they continue for three or four days. If the vesicular-like elevations, described above as occurring in lymph scrotum, are pricked, a stream of lymph is ejected with considerable force and continues to flow for some time. The fluid is at first quite limpid, but gradually becomes less clear and often tinged with red. It coagulates rapidly on exposure to the air. In some cases the later portion of fluid is opalescent, milky or sanguineous. In cases of obstruction of the lymphatics due to filariæ, discharges of chylous fluid take place into the urinary passages constituting the symptom which is termed *chyluria*. In these cases the urine is of a milky colour and appearance; sometimes yellowish or pinkish. Such urine coagulates almost immediately after it is passed and often coagulates within the bladder itself. When this occurs, great difficulty may be experienced in emptying the bladder, and clots are passed with the urine.

The presence of embryo filariæ in the blood.—Certain diseases of the lymphatic system, such as elephantiasis, lymphangiectasis, lymph scrotum, chyluria, and some cases of orchitis, hydrocele, and synovitis are due to lesions induced by the presence, in some part of the lymph channels, of the *filaria sanguinis hominis* or *filaria Bancrofti.* In such cases the embryo filariæ will, in many instances, be found in the blood. The detection of these embryos in the blood will often assist in establishing a diagnosis as to the true nature of the disease, and hence it is important to know the best method of discovering their presence. In the first place the investigation should, if possible, be undertaken between the hours of 10 P.M. and 2 A.M. It is of no use looking for the embryos in the day time. To obtain the blood the tip of one of the patient's fingers is carefully cleaned and then, having been compressed between the finger and thumb of the operator, is sharply pricked with a clean pin and a drop of blood allowed to escape. The blood is quickly transferred to a clean slide, being made to flow over its surface so as to form a very thin transparent film. The spreading of the drop of blood may be assisted, if necessary, by means of the pin. The film of blood is then allowed to dry and may be examined at once or at any future period. No cover glass is necessary. Several slides should be prepared and the whole of each preparation should be carefully and *systematically* searched with a low power (½ inch) and not too strong a light. If no embryos are found, it must not be concluded that none are present, but further search should be made. The appearance of the embryos is shown in the accompanying plate.

The presence of the mature filariæ in the lymphatics.—The mature parasite is, as already stated, sometimes found in the contents of abscesses. It has also been found in the fluid of a hydrocele, and in the tissues of a lymph scrotum, and in the lymphatic glands in a case of lymphangiectasis. The worms have the appearance of portions of fine thread, the female being about 3½ inches in length and the male very much smaller. The microscopical appearances are shown in the accompanying plate.

CHAPTER VIII.

EXAMINATION OF THE ABDOMINAL ORGANS.

This examination should be made with the patient in the recumbent position, the shoulders being slightly raised by a pillow and the thighs flexed on the abdomen, so that the abdominal muscles may be relaxed. The abdomen should be properly exposed. While examining the patient it is well to engage him in conversation. By thus distracting his attention a state of contraction and tension of the abdominal muscles may be avoided.

The viscera are situated in the different regions of the abdomen as follows :—

Epigastric region.—The right part of the stomach, the pancreas, and part of the liver.

Hypochondriac, right.—The right lobe of the liver with the gall bladder, part of the duodenum, the hepatic flexure of the colon, part of the right kidney with the corresponding supra-renal capsule.

Hypochondriac, left.—The large end of the stomach with the spleen and narrow extremity of the pancreas, the splenic flexure of the colon and the upper part of the left kidney with the left supra-renal capsule. Sometimes also a part of the left lobe of the liver.

Umbilical.—Part of the omentum and mesentery, the transverse part of the colon, lower part of the duodenum, with some convolutions of the jejunum and ileum. Division of aorta one inch and a half below umbilicus. A more reliable guide to this division than the umbilicus is a point a very little to the left of the middle line about the level of the highest part of the crest of the ileum.

Lumbar, right.—The ascending colon, lower half of the kidney, and part of the duodenum and jejunum.

Lumbar, left.—The descending colon and lower part of the left kidney, with great part of the jejunum.

Hypogastric.—The convolutions of the ileum, the bladder in children, and if distended in adults also; the uterus when in the gravid state.

Iliac, right.—The cæcum, with the appendix vermiformis and the termination of the ileum.

Iliac, left.—The sigmoid flexure of the colon.

The following notes have been principally compiled from Guttmann's valuable *Hand-book of Physical Diagnosis* :—

Inspection.—This is not as a rule of much assistance; it must be checked by palpation; enlargement may be *partial* or *general;* partial enlargement is most commonly due to increase in the size of certain of the subjacent organs, as the liver, spleen, uterus, or ovaries. Dilatation of the stomach gives rise to a uniform, somewhat oval-shaped swelling in the epigastric region. Cancer of the stomach only manifests itself when the tumour is large. Large fæcal accumulation in the colon forms an elongated and often movable tumour which constantly varies in position from day to day in the right or left side. Peristaltic movements in the bowels are seen in the portion of the bowel above the seat of a stricture. Tumours of the omentum sometimes attain a large size. Tumours of the uterus, physiological (pregnancy) and pathological (fibromas, &c.), so long as they are not of unusual size, keep generally to the middle line of the abdomen. Tumours of the ovaries first make their appearance low down in the abdomen, in the region corresponding to the anatomical site of the organs, to one or other side of the median line. Often when large it is impossible to say at which side they commenced to form. As a rule they are movable.

Diseases of the *kidneys*, which may be recognized on inspection, are *cancers* and *hydro-nephrosis* when large. A *dislocated* or movable kidney may occasionally be met with. The bladder when distended with urine projects in the median line.

Uniform general intumesence of the abdomen is produced most commonly by the presence of some abnormal material in the peritoneal *sac* (usually fluid, more seldom gas), or by distension of the intestines by gas.

Distension of the superficial abdominal veins is a sign of obstruction of the portal circulation.

Diminution in volume (*depression*) is usually accompanied with signs of general emaciation. The boat-shaped depression of the surface of the abdomen, noted by Trousseau in the basilar meningitis of children, is caused by the contraction of the muscular coat of the intestines from irritation of the nervous centres which govern the movements of the bowel.

Palpation.—The patient's attention should be diverted during the examination. In some cases it may be necessary to give chloroform in order to get the abdominal muscles fully relaxed. Palpation is a method of the first importance in the investigation of abdominal diseases. It enables us to determine the size, form, consistence, and situation of the various organs, and discloses the existence of tenderness to superficial or deep pressure, the presence of any abnormal substance or body in the abdominal cavity, &c. It is most conveniently practised when the patient is laid on his back, or occasionally, on one or other side, sometimes with the thighs flexed. If the abdominal organs are in their normal condition, the hand meets with no unusual resistance when applied to the surface; any spasmodic contraction of the muscles of the abdomen should be looked upon with suspicion, as it commonly points to some internal irritation. The hand should be warmed, in cold climates, before being placed upon the abdomen.

Palpation of the Liver.—This may demonstrate displacement, alteration in shape, enlargement or contraction. In the normal condition it can only be felt as a sense of resistance below the arch of the ribs. There may be enlargement without pain, or enlargement with pain, there may be tenderness and œdema of the superficial structures. Note the character of the surface, whether smooth or rough, its consistence, any change of form, the presence of fluctuation, or of the 'hepatic fremitus of Briancan,' which is characteristic of echinococci in the liver. A distended gall bladder is sometimes seen. In children the liver is lower in proportion to the other viscera, often extending from the lower border of the ribs on the right side to the level of the umbilicus.

Palpation of the Spleen.—As long as it retains its normal dimensions it cannot be touched with the palpating fingers. On palpating during deep inspiration while the patient is lying on his right side, a slight degree of enlargement may be felt deep in the left hypochondrium. During a paroxysm of ague it nearly always becomes enlarged. When enlarged it generally retains its original form, the enlargement being nearly equal in all its diameters. Note its consistence, the state of its surface, and whether it is *dislocated*, *movable*, or *wandering*.

Palpation of the Stomach and Intestinal Canal.—Note if there is any pain, tenderness, new formations, or fæcal accumulations (irregular movable masses changing in shape from day to day). Peristaltic action in cases of stricture, obstruction, or intussusception of the intestine is sometimes seen. Pain and tenderness in the right iliac fossa are found in inflammation of the cæcum, enteric fever, and perforation of the vermiform appendix. Tumours of the omentum, of the pancreas, and of the retro-peritoneal glands can sometimes be defined. In diseases of the peritoneum when there is accumulation of fluid in the peritoneal sac, fluctuation may be felt. Movement of ascitic fluid, when it is not circumscribed, may be noticed on change of position. There is pain in peritonitis. Irregular nodules may be felt in cancerous growths. Frémissement is occasionally felt when two of the peritoneal surfaces are roughened and rub against each other.

Palpation of the Genito-urinary Apparatus.—The kidneys are sometimes *movable* or *wandering;* they are enlarged in inflammation, in new growths, and in hydronephrosis. The kidneys in their normal position can only be felt in thin persons. Œdema may often be found in the lumbar region in cases of chronic albuminuria. A distended bladder is felt as a firm, elastic, oval-shaped tumour, in the pubic and umbilical regions. Hypertrophy of the prostate can be felt through the rectum. For examination of tumours of the ovaries and uterus see chapter on Diseases of Women.

Aneurism of the abdominal aorta may be found in any part of its course, or in any of its large branches. When the tumour can be felt, its pulsating character is easily recognised; but it is often difficult to tell whether the pulsation is in the tumour or communicated to it. When it is in it the true expansile character in all directions can be recognised by grasping it between the fingers or placing a stethoscope on it and observing the direction it moves in. Obscure cases can only be diagnosed by the method of exclusion.

Percussion should be practised when the patient is lying on his back. It is directed to the delimitation of certain organs,—the liver, spleen and gastro-intestinal canal, very rarely the kidneys. The pancreas, ovaries, and uterus, when of their normal size, are not definable by percussion. Its diagnostic importance is merely secondary; the information gained by palpation is much more reliable.

Percussion of the Liver.—The normal area of *absolute hepatic dulness* extends on the front of the chest from the sixth rib superiorly to the margin of the arch of the ribs inferiorly, and reaches in the median line to midway between the base of the xiphoid cartilage and the umbilicus; over this there should be always a dull sound on percussion. The area of *relative dulness*, which is caused by the presence of a portion of the lung in front of the convex surface of the liver, extends as high as the fifth intercostal space; it can rarely be defined exactly. The movements of respiration and alterations in the position of the body change the position of the liver a little.

It should be percussed during the respiratory pause, and generally along four lines—the *axillary*, *mammary*, *lateral sternal*, and *median*.

The *upper boundary* of the normal hepatic dulness is found at the eighth rib in the *axillary line;* at the upper (sometimes at the lower) border of the sixth rib in the *mammary line;* at the upper border of the fifth rib (sometimes in the fifth intercostal space) in the *lateral sternal line;* and at the base of the xiphoid process in the *median* line. Posteriorly the liver rises as high as the level of the tenth rib.

The *lower limit* of the hepatic dulness is situated between the tenth and eleventh ribs in the *axillary line*, in the *mammary* and *lateral sternal* lines it comes close to the edge of the arch of the ribs. In women it is sometimes lower owing to tight lacing. In the *median* line the hepatic dulness reaches downwards to nearly midway between the base of the xiphoid cartilage and the umbilicus; from the *median* line it extends about ten lines, at most an inch to the left, where its lower edge, turning upwards, passes into the lower margin of the cardiac dulness.

Posteriorly the lower boundary of the liver dulness is no longer demonstrable beyond the scapular line in which it is situated at the level of the eleventh rib; the dulness is here undefinable, being lost in that arising from the thick mass of the dorsal muscles. The percussion sound is not equally dull at all parts of the hepatic area, as it is modified by the proximity of the stomach and bowels.

Percussion of the spleen is carried on equally well while the patient is in the sitting, standing, or in the recumbent posture. When enlarged it should be tested in the two latter. If the patient is lying on the right side, the area of dulness shifts. The percussion note is less dull and less certain than that of the liver on account of its surroundings. It should be percussed during the respiratory pause. The long diameter of the spleen is directed obliquely from above and behind, downwards and forwards. Its upper or posterior end is situated close to the body of the tenth dorsal vertebra in the concavity of the diaphragm, and under the edge of the left lung, while its lower and anterior end is found behind the eleventh rib near its free termination, that is, somewhat posterior to the middle axillary line. The *anterior* border of the spleen runs parallel with the ninth rib, the posterior parallel with the eleventh. The organ is more or less rounded at its upper and lower ends.

Percussion of the Stomach.—It is impossible to limit this organ on account of its surroundings. The *pitch* of the note depends on the contents of the organ.

Percussion of the Intestines.—In health the percussion sound over both the large and small intestines is always tympanitic, the sound varying according to the contents.

Percussion of the kidneys is not of much use; percussion of the bladder or uterus is only of use when they are enlarged.

Auscultation is not of much use, as the sounds are, as a rule, merely accidental and irregular in occurrence (except the placental murmur and the sounds of the fœtal heart). Auscultation of the œsophagus is sometimes of use in case of stricture. Auscultation of the stomach and intestines gives gurgling and rumbling sounds (borborygmi). Occasionally friction murmurs may be heard where there is some roughness of the peritoneal coat. Clicking of gall stones in the gall bladder has been heard.

Examination of Vomited Matters.—Note the reaction; whether there is hæmatemesis from its coffee-ground appearance; examine microscopically for sarcinæ; note the smell, and whether the vomited matter is stercoraecous or not. Worms are sometimes vomited. (See the chapter on the Use of the Microscope.)

Examination of the Intestinal Discharges.—(See chapter on the Examination of the Intestinal Discharges.)

CHAPTER IX.

ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYSTEM.

The following summary of the anatomy and physiology of the nervous system has been written with the two-fold object of helping the student about to commence the clinical study of that system, and of refreshing the memories of that large number of Licentiates and Hospital Assistants, &c., who, through lapse of time or from other causes, have forgotten much that they have learned in this relation. The different structures are purposely described from the cerebrum downwards and not from the spinal cord upwards, as being the more convenient method in a clinical account.[*]

The Cerebro-Spinal Axis[†] (*i.e.*, the brain and spinal cord) is *symmetrical* throughout in form and structure, and consists of a right and left half separated to a certain extent by longitudinal fissures, but united by various portions of white and grey substance which cross from one side to the other and form the *commissures* of the brain and spinal cord. From these two symmetrical halves proceed at intervals the various nerves which go to supply the bodily structures. The whole may be compared aptly to an intricate, but marvellously efficient, telegraphic system, with its head-quarters situated in the cerebrum and numerous intermediate stations for transmitting messages to and from head-quarters to outlying districts, or from one station to another, or even from one district to another without the message going to head-quarters at all. The messages so transmitted are of two chief classes, *sensory* or *afferent* and *motor* or *efferent*. Under the heading of afferent nerves are also included the *nerves of special sense* and the *reflex motor*, *reflex inhibitory*, and *reflex secretory* nerves. Under efferent nerves are included, in addition to motor nerves, *secretory*, *trophic*, *inhibitory*, (?) *thermal* and (?) *electrical* nerves. It must not be forgotten that at numerous places the wires cross or 'decussate,' so to speak, and also that, as in modern telegraphy, the same wire (nerve) may probably carry different messages at the same time.

The Brain (or Encephalon) is made up, from above downwards, of the *cerebrum*, the *cerebellum*, the *pons Varolii* and the *medulla oblongata* which connects it with the spinal cord. The cerebrum is continuous with the other structures by means of a constricted portion (*isthmus*), part of which joins the cerebellum, whilst another part, constituting the *crura cerebri*, passes through the pons into the medulla.

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[*] Before commencing the study of this chapter, the student is earnestly requested to read carefully the general account of the structure and function of nervous tissues in some small, but standard, text-book of physiology.

[†] In this and the following chapter the writer has chiefly followed *Quain*, but has also referred, where necessary, to Landois and Stirling's *Physiology*, Ellis' *Anatomy*, Obersteiner's and Hill's *Anatomy of the Central Nervous System*, and the Clinical Works of Vierordt, Musser, Judson Bury, Russell and Gibson, &c.

CEREBRUM.

The division of the different parts into the *cerebral hemispheres* (cerebrum proper), the *thalamencephalon* (fore-brain), which includes the optic thalami, middle commissure and neighbouring structures, and the *mesencephalon* (mid-brain), which includes the corpora quadrigemina and crura cerebri, is convenient for purposes of description. The cerebral hemispheres together form an ovoid mass and are divided throughout their greater extent by the *longitudinal fissure*. Each hemisphere has an outer, convex surface, an inner, flat surface and an irregular under surface. The under surface is divided by a deep cleft, the commencement of the fissure of Sylvius.

Corpus Callosum.—Anteriorly and posteriorly the longitudinal fissure extends right through to the base of the brain, but in the middle it is interrupted by the *corpus callosum* (great commissure), a mass of white substance connecting the two hemispheres. Anteriorly the corpus callosum bends downwards and backwards (the *genu* or knee) and terminates by joining the lamina cinerea. Posteriorly it ends in a free thickened border (*splenium*) which lies over the mesencephalon. Its under surface is connected in front with the septum lucidum * and behind with the fornix, whilst laterally it roofs in the bodies and anterior cornua of the lateral ventricles.

Fissures and Convolutions of the Hemispheres.—The surface of the hemispheres is composed of grey matter covered everywhere with vascular *pia mater*, and is increased in extent by being thrown into convolutions (*gyri*) separated by furrows (*sulci*). The convolutions are roughly divided into five groups or lobes, viz., the *frontal*, *occipital*, *temporo-sphenoidal* and *central lobes*. † The three chief sulci are known as the *fissure of Rolando*, the *fissure of Sylvius* and the *parieto-occipital fissure*. The Sylvian fissure commences on the under surface of each hemisphere, as noted before, near the anterior perforated space, and runs outwards to the lateral surface where it divides into two 'limbs'—an anterior, short one terminating in the frontal lobe, and a posterior,

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* Vertical partition between the lateral ventricles.

† The olfactory 'nerve' is sometimes constituted a sixth lobe, the *olfactory lobe*.

PLATE IV

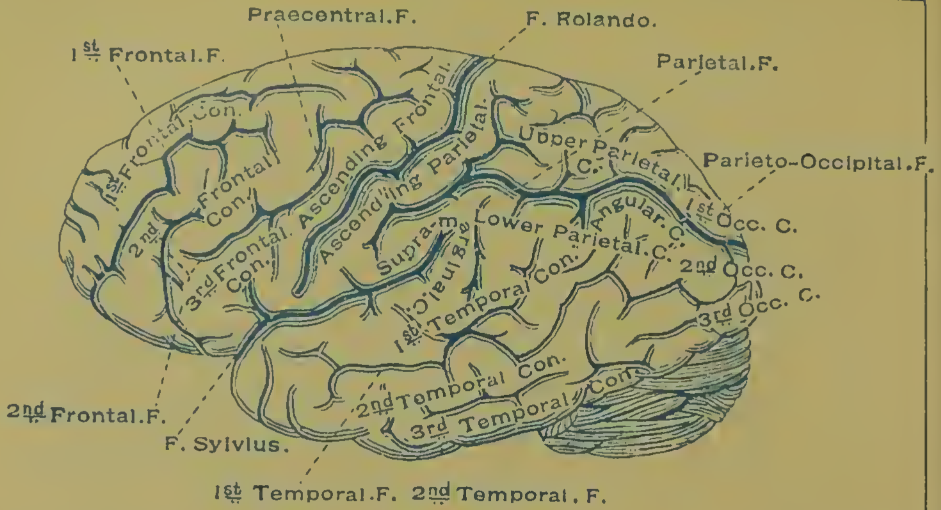

Fig.1.

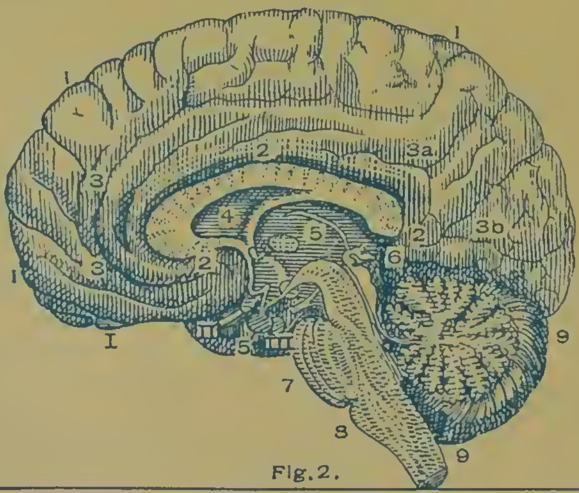

Fig.2.

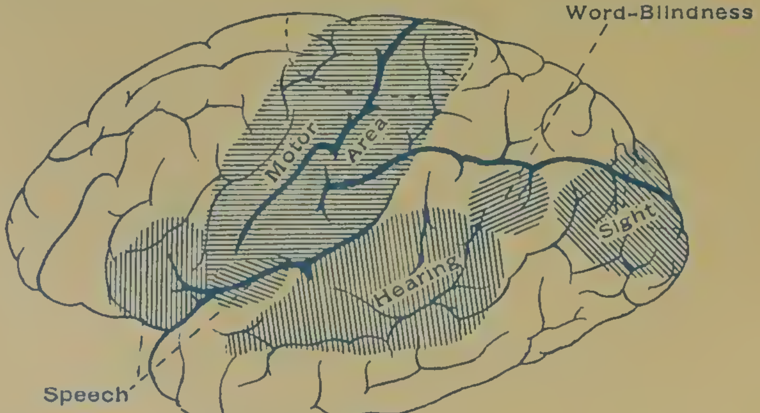

Fig.3.

PLATE IV.—CONVOLUTIONS AND AREAS OF THE CEREBRUM.

Fig. 1. Convolutions of the left Hemisphere.

Fig. 2. Right Half of the Brain divided by a vertical Anteroposterior section: 1, 2, 3, 3*a*, 3*b*, are placed on convolutions of the cerebrum; 4, the fifth ventricle, and above it the divided corpus callosum; 5, the third ventricle; 5′, pituitary body; 6, corpora quadrigemina and pineal gland; +, the fourth ventricle; 7, pons varolii; 8, medulla oblongata; 9, cerebellum; I, the olfactory bulb; II, the right optic nerve; III, right third nerve.

Fig. 3. Diagram showing Localisation of the Centres in the Cortex.

longer branch separating the temporo-sphenoidal and parietal lobes.* The fissure of Rolando is a very prominent sulcus separating the parietal from the frontal lobe. The fissures of the two sides when looked at from above form a V-shaped figure, open in front. It ends just posteriorly to the bifurcation of the Sylvian fissure. The parieto-occipital fissure, as its name implies, marks the boundary between the parietal and occipital lobes. It is more distinctly seen on the inner (mesial) surface of the hemisphere. There are numerous other fissures on the outer and inner surfaces which cannot be noticed here.

The frontal lobe is divided into the *ascending frontal convolution* (the anterior boundary of the fissure of Rolando), and three other convolutions anterior to this, more or less distinctly visible into the *superior*, *middle* and *inferior frontal convolutions.* The parietal lobe lies between the frontal and occipital lobes. The *ascending parietal convolution* forms the posterior boundary of the fissure of Rolando. The *superior parietal convolution* or lobule lies behind the upper portion of this convolution and in front of the occipito-parietal fissure, and is connected above with the ascending parietal convolution. The remaining portion of the parietal lobe consists of the *inferior parietal convolution* (or lobule) which is subdivided into the *supra-marginal convolution* and the *angular gyrus* (or convolution). The occipital lobe is divided somewhat indistinctly into *superior*, *middle* and *inferior* occipital convolutions which are connected by small *annectant* convolutions with the parietal and temporo-sphenoidal lobes. The temporo-sphenoidal lobe is bounded above by the posterior limb of the Sylvian fissure and in front by the same fissure. It is described as consisting of three convolutions, *superior*,† *middle* and *inferior*. The convolutions on the inner or mesial surface of the hemispheres can be seen in the figure. Anteriorly there is the *marginal convolution*, bounded below by the *calloso-marginal fissure*, and which belongs to the frontal lobe. Next this comes the *paracentral lobule*, the name given to the inner surface of the ascending frontal and parietal (or anterior and posterior central) convolutions. Then comes the *quadrate lobule* of the parietal lobe and the cuneate lobule of the occipital lobe. Between the calloso-marginal fissure and the corpus callosum is situated the *gyrus*

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* The group of convolutions between the two branches of the fissure is known as the *operculum* (*i.e.*, 'cover'), and by raising this upwards the central lobe is exposed to view.

† Sometimes termed from its position the *infra-marginal convolution.*

fornicatus (or convolution of the corpus callosum) connected with the quadrate lobule above and the uncinate convolution below. Lastly, the *central lobe* (or island of Reil) is a triangular eminence lying deeply within the commencement of the Sylvian fissure and consisting of several short convolutions which radiate outwards from a point just external to the anterior perforated space. It covers the lenticular nucleus of the corpus striatum.

Lateral Ventricles.—Underneath the corpus callosum are situated the lateral ventricles of the hemispheres, each consisting of a *body*, an *anterior*, a *posterior* and a *descending cornu.* The ventricles are separated from one another by the septum lucidum * (stretching between the corpus callosum and the fornix), and their floor is formed from behind forwards and from without inwards by (1) part of the fornix, (2) the choroid plexus, (3) part of the optic thalamus, (4) the tænia semicircularis, separating the optic thalamus from (5) the nucleus caudatus of the corpus striatum. Each lateral ventricle communicates with the third ventricle by means of the so-called *foramen of Monro.*†

Corpora Striata‡.—These are two large ovoid masses of grey matter situated in front of the outer side of the optic thalami. The larger part of each is contained within the substance of the hemisphere—*extra-ventricular* portion; the smaller forms part of the boundary of the lateral ventricle —*intra-ventricular* portion. The former is known as the *lenticular nucleus*, the latter as the *caudate nucleus*, and they are separated the one from the other by the layer of white substance known as the internal capsule. On the outer side of the lenticular nucleus is a sheet of grey matter, the *claustrum*, smooth on its inner side but furrowed externally, the elevations and depressions corresponding to the convolutions of the central lobe.§ It is separated from the lenticular nucleus by a layer of white matter, the *external capsule*, and is in immediate contact with the white matter of the central lobe. Anteriorly the two nuclei of the corpus

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* The fifth ventricle is situated between the layers of this structure hence the name ' ventricle of the septum.'

† The student should also refer to the structure and position of the *septum lucidum*, *fornix* and *velum interpositum*, the last being a prolongation of pia mater over the third ventricle and optic thalami, and the free edges of which constitutes the choroid plexus.

‡ The ' Striate ' appearance is due to bundles of white fibres from the internal capsule, &c., passing into the grey matter.

§ *Vide* preceding page.

PLATE V

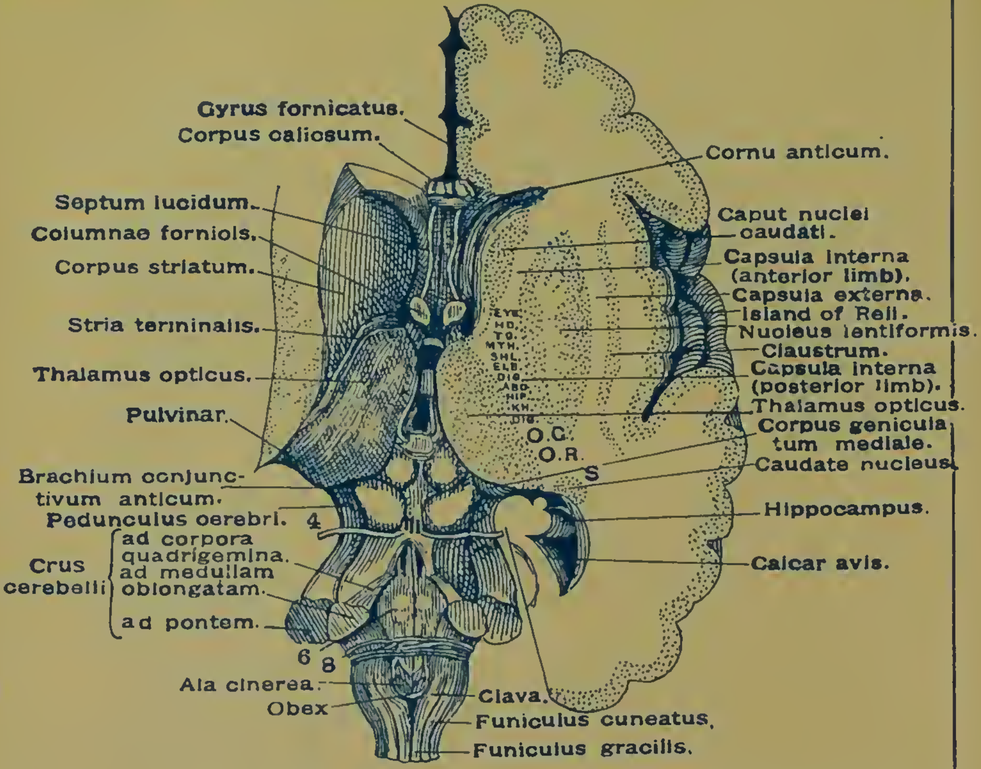

Fig. 1

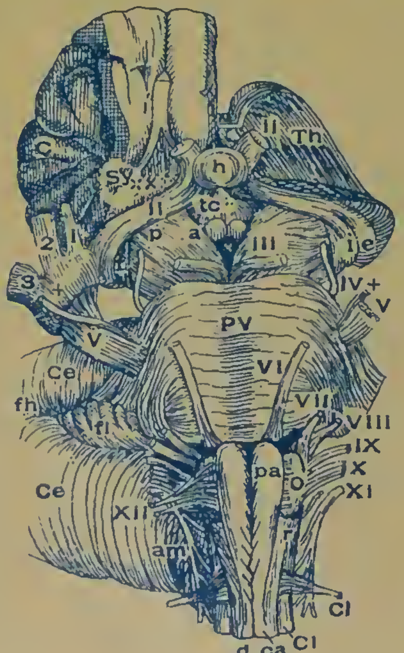

Fig. 2.

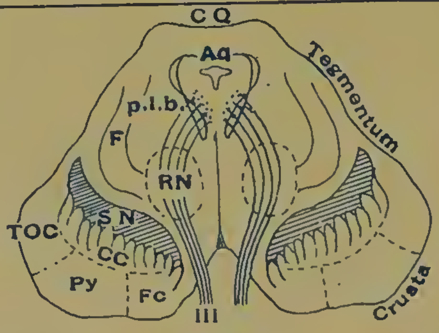

Fig. 3.

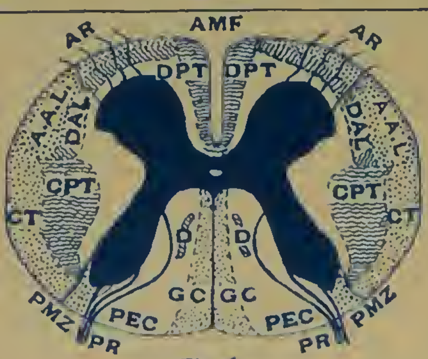

Fig. 4.

To face p. 84.

PLATE V.—VIEWS OF THE BRAIN AND SPINAL CORD.

Fig 1. Human Brain with the Hemispheres removed by a Horizontal Incision on the Right Side: 4, trochlear; 8, acoustic nerve; 6, origin of the abducens; relative positions of the pyramidal (motor) fibres of the eye, head (HD), tongue (TG), mouth (MTH), shoulder (SHL), elbow (ELB), fingers (DIG), abdomen (ABD), hip, knee (KN), toes (DIG), in the posterior limb of the internal capsule; O.C., fibres to the occipital lobes; O.R., fibres to optic radiation; S, sensory fibres.

Fig. 2. View from before of the Medulla Oblongata, Pons Varolii, Crura Cerebri, and other Central Portions of the Encephalon: (Allen Thomson.) Reduced: On the right side the convolutions of the central lobe or island of Reil have been left, together with a small part of the anterior cerebral convolutions: on the left side those have been removed by and incision carried between the thalamus opticus and the cerebral hemisphere.

I′, the olfactory tract cut short and lying in its grove; II, the left optic nerve in front of the commissure; II′, the right optic tract; *Th*, the cut surface of the left thalamus opticus; C, the central lobe or island of Reil; *Sy*, fissure of Sylvius; × ×, anterior perforated space; *e*, the external, and *i*, the internal, corpus geniculatum; *h*, the hypophysis cerebri or pituitary body; *tc*, tuber cinereum with the infundibulum; *a*, one of the corpora albicantia; P, the cerebral peduncle or crus; III, close to the left oculo-motor nerve; ×, the posterior perforated space.

The following letters and numbers refer to parts in connection with the medulla oblongata and pons. PV, pons varolii; *V*, the greater root of the fifth nerve; +, the lesser or motor root; *VI*, the sixth nerve; *VII*, the facial; *VIII*, the auditory nerve; *IX*, the glossopharyngeal; *X*, the pneumogastric nerve; *XI*, the spinal accessory nerve; *XII*, the hypoglossal nerve; C I, the suboccipital or first cervical nerve; *p a*, pyramid; *o*, olive; *d*, anterior median fissure of the spinal cord, above which the decussation of the pyramids is represented; *c a*, anterior column of cord; *r*, lateral tract of bulb continuous with *c l*, the lateral column of the spinal cord.

Fig. 3. Scheme of Transverse Section of the Cerebral Peduncles: CQ, corpora quadrigemina; Aq, aqueduct; p. l. b., posterior longitudinal bundle; F, fillet or lemniscus; RN, red nucleus; SN, substantia nigra; III, third nerve; Py, pyramidal tracts; Fc, fronto-cerebellar; TOC, temporo-occipital fibres of the crusta: C C, caudate cerebellar fibres in upper part of crusta.

Fig. 4. Schematic Horizontal Section of Spinal Cord, showing Nerve Tracts: AMF, anterior median fissure; DPT and CPT, direct and crossed pyramidal tracts; AR and PR, anterior and posterior nerve-roots; AAL, and DAL, ascending and descending antero-lateral tracts; CT, cerebellar tract; D, comma-shaped tract; PMZ, posterior marginal zone; PEC, postero-external column; GC, column of Goll or postero-internal column.

N.B.—The parts left white do not undergo degeneration.

striatum are united and bands of grey matter pass across the internal capsule: posteriorly the lenticular nucleus is connected with the anterior perforated lamina.

THALAMENCEPHALON.

Under this heading are included the third ventricle and the parts in connection with it, of which the optic thalami are specially important.

Third Ventricle.—This is an expansion of the Sylvian aqueduct * which takes place as the latter passes beneath the posterior commissure, and it extends forward as far as the anterior commissure. It is bounded laterally by the optic thalami, and its floor, from before backwards, is formed by (*a*) the tegmenta of the crura cerebri, (*b*) the posterior perforated space, (*c*) the corpora albicantia, (*d*) the tuber cinereum, (*e*) the infundibulum, and (*f*) the lamina cinerea. There are three *commissures* in connection with this ventricle—the *anterior* crossing between the corpora striata, the *middle* formed by a band connecting the optic thalami, and the *posterior* formed of fibres from the corpora quadrigemina and optic thalami. As in the lateral ventricles, the third ventricle is roofed over with a portion of the velum interpositum from which depends the choroid plexus.

Optic Thalami.—These are two oval-shaped masses of grey matter situated in immediate relation to the corpora striata and lateral ventricles in front, to the third ventricle by their mesial or inner surface, as before mentioned, whilst posteriorly their ends are free and adjacent to the dorsal parts of the mesencephalon—the corpora quadrigemina. Each is marked by a shallow groove on its upper surface, which runs from behind forwards and inwards. The outer and anterior portion projects into the lateral ventricles, the rounded extremity being known as the *anterior tubercle*, and is separated from the nucleus caudatus of the corpus striatum by a band of white matter, the *stria terminalis*.† The posterior, rounded extremity of the thalamus is termed the *pulvinar*.‡ The mesial or inner surface bounds the third ventricle and the middle or soft commissure joins these surfaces. Just below the pulvinar on each side are situated the external and internal geniculate bodies,* and between the two the pineal gland and corpora quadrigemina are seen. The under surface is not free but united with the tegmental portion of the crus cerebri. The relation of the external surface is described below.

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* The small channel leading from the fourth to the third ventricle, *vide post.*

† Or *tænia semicircularis*: *vide ante*, 'lateral ventricles.'

‡ Or *posterior tubercle*.

Internal Capsule.—It is a tract of white substance composed chiefly of nerve fibres on their way from the base of the brain to the cortex and *vice versâ.* It is part of the grand trunk line in the 'telegraphic system' before alluded to and it is imperative for the student to understand its situation, blood supply, &c., as it is a very common seat of serious cerebral disease. The external surface of the optic thalamus is not free, but is covered by white substance formed of the fibres of the crusta † which, as they diverge into the hemisphere, run between the thalamus and lenticular nucleus and afterwards between the lenticular and caudate nuclei. These fibres constitute the internal capsule which is thus divided into a *posterior* and an *anterior limb*, the bend at the junction of the two being called the *genu.*‡

Other structures in relation to this portion of the brain are the *posterior perforated space*, the *corpora albicantia*, the *tuber cinereum*, the *pituitary body*, the *optic commissure*§ and the *lamina cinerea.*

MESENCEPHALON.

The mesencephalon or mid-brain is the term applied to the Sylvian aqueduct and the parts in connection with it, including the nuclei of the third, fourth and fifth nerves, the crura cerebri, corpora quadrigemina, etc.

Aqueduct of Sylvius.—This is the narrow channel of communication between the third and fourth ventricles and is about 0·5 inch in length. Like the ventricles, it is lined with ciliated columnar epithelium continuous with that of the central canal of the spinal cord, and outside of which is a thick layer of grey matter prolonged from the fourth ventricle, *the grey matter of the aqueduct.* In this grey matter are nuclei for the third, fourth, and fifth (upper nucleus) nerves. External to this grey matter, the "lateral and ventral (basal) parts of the mesencephalon are composed of the thick masses of the crura cerebri, whilst the roof or posterior wall is formed by the *lamina quadrigemina*, so called from bearing the four mammillated tubercles known as the corpora quadrigemina."

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* *Vide post.*

† Hence the internal capsule is sometimes called the *radiation of the crusta.*

‡ The course of the fibres in this part, so far as known, will be found at p. 99 *et seq.*, and the blood supply at p. 94 *et seq.*

§ *Vide* 'visual tract,' p. 98.

The Crura Cerebri or peduncles of the cerebrum, diverging as they issue from the upper border of the pons Varolii, pass upwards and forwards to enter the cerebral hemisphere under tho optic tracts. Each crus is divided into two portions, (*a*) the *crusta* or cerebral peduncle proper which overlies and almost conceals, (*b*) the *tegmentum* or portion forming the immediate central support of the Sylvian aqueduct. Between the crusta and tegmentum of each crus is the *substrantia nigra*—a mass of grey matter seen on section—which comes to the surface at a groove in the inner margin of the crus and from which groove issues the third or oculomotor nerve of each side. The fibres of the crusta are directly continuous with the pons (pyramid bundles) on the one hand and with the internal capsule on the other. The fibres of the tegmentum aro the upward continuation of the formatio reticularis of the pons and run upwards into the optic thalami. Besides these fibres there are many others connected with the corpora quadrigemina, cerebellum, &c., which cannot bo further noticed here.

The corpora quadrigemina are situated upon the dorsal covering of the Sylvian aqueduct, or quadrigeminal lamina, as before noted. This latter is grooved mesially, thereby separating the corpora quadrigemina of one side from tho other; its upper part being covered by the posterior commissure * and concealod by the pineal gland. On each side there are two corpora or tubercles—a *superior* or *anterior* and an *inferior* or *posterior* separated from one another by a transverse groove. They are composed mainly of grey matter covered with a thin layer of transverse fibres. Laterally each tubercle is prolonged upwards and forwards into a tract of white matter, the *brachium*. The lower or posterior brachium ends in *the inner geniculate body*, which is possibly one of tho roots of the optic tracts.† The upper or anterior brachium passes beneath the prominent end of the thalamus and the external geniculate body to join those structures, and thus forms one of the roots of the optic tract,* but some of its fibres pass through the thalamus and ultimately reach the cerebral cortex by the *corona radiata*.†

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* *Vide ante*, third ventricle.

† Probably these fibres are commissural, for they remain unaffected by extirpation of the opposite eye (Quain).

We next come to the parts which lie around the upper portion of the fourth ventricle, viz., the cerebellum and pons Varolii. The cerebellum forms the dorsal boundary of this portion, whilst the ventral or anterior aspect of the cavity is bounded by a strongly-marked bundle of fibres which issues on either side from the hemispheres (of the cerebellum)—their so-called *middle peduncle*, and encircles and partly blends with what is practically a continuation upwards of the medulla oblongata: the whole forming a well-marked projection and thickening of the fourth ventricle, known as the pons Varolii.

PONS VAROLII.

The pons Varolii, then, is situated anteriorly just above the upper portion of the medulla oblongata and between the lateral hemispheres of the cerebellum. At the sides its transverse fibres become gathered into a bundle which passes into the cerebellum, forming the middle peduncle (or *Crus*) of the latter. On the ventral surface it is largely composed of transverse or commissural fibres, but between these are longitudinal fibres from the medulla passing upwards and small tracts of grey matter. This surface is marked by a mesial groove in which the basilar artery lies. The dorsal or posterior surface is composed largely of a continuation upwards of the formatio reticularis and grey matter of the medulla. As in the crura cerebri, this part of the pons, in close proximity to the ventricle, is known as the *tegmental* portion, in distinction to the anterior or *ventral* portion. The course of the fibres in the pons is very complicated and within its substance are situated several very important nuclei of the fifth, sixth, seventh, and eighth cranial nerves.

CEREBELLUM.

The Cerebellum or hind-brain consists of two somewhat flattened *lateral hemispheres* connected by a central portion, the *middle lobe* (or vermiform process).‡ The middle lobe is subdivided into a *superior* vermiform process and an *inferior*, more prominent, vermiform process. Behind, the two hemispheres are separated by a deep notch continuous below with a fossa, the *vallecula*, into which projects the inferior vermiform process. Into this hollow the medulla oblongata is fitted in front whilst the falx cerebelli dips in behind. The surface of the cerebellum is arranged in a series of folds or *laminae* divided by *sulci*. Some of these latter are larger than others and are distinguished as *fissures*, the portion of cerebellum included between the fissures being described as *lobes*. The chief fissure is that known as the *great horizontal fissure* which begins in front at the middle peduncle and runs round the outer and posterior borders of the lateral hemispheres, the two halves meeting or uniting with one another in the posterior notch. By this fissure the upper and lower surfaces of the cerebellum are marked off, and each surface, as noted above, is divided into numerous lobes made up in turn of laminae. On section, the cerebellum has a very characteristic appearance owing to the fact that the white matter is placed internally and branches in all directions, whilst the grey matter surrounds these branches to their smallest ramifications. There is thus produced an arborescent or tree-like appearance to which the name *arbor vitæ* has been given. Each hemisphere contains, however, half-way between its centre and the middle of the vermiform process, an isolated grey nucleus of dentate or pinnate form, known as the *corpus dentatum*, made up of white matter in its centre and sending fibres to the superior peduncles and to the valve of Vieussens. The cerebellum is connected to the other portions of the brain on each side by three peduncles. The *superior peduncles* * are concealed in the natural condition by the anterior portion of the cerebellum. They run upwards and forwards to disappear under the corpora quadrigemina and communicate with these bodies and the crura cerebri. The *middle peduncles* † are commissural and pass to the pons as noted above. The *inferior peduncles* ‡ go to form part of the lateral wall of the fourth ventricle, at which point they turn downwards at a right angle and become identical with the restiform bodies of the medulla.

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* The fibres of this brachium, the external geniculate body and neighbouring portions of the optic thalamus undergo degeneration when the eye of the opposite side is extirpated (Quain).

† The name applied to the fibres, chiefly from the internal capsule, which radiate outwards in all directions to the cortex cerebri.

‡ So named from its supposed 'worm-like,' appearance.

MEDULLA OBLONGATA.

The Medulla Oblongata is the connecting link between the spinal cord and the brain. It extends from the lower border of the pons to the level of the upper edge of the atlas. Anteriorly it rests upon the hollowed basilar process of the occipital bone, whilst posteriorly it fits into the notch between the lateral lobes of the cerebellum, as before mentioned. In the medulla the fibres from the spinal cord are rearranged, as also the grey matter, and new grey matter is added. Like the spinal cord it is divided into two halves by an *anterior* and *posterior median fissure.* The anterior median fissure ends above at the pons in a blind dilatation, the *foramen cæcum*, whilst below it is partly interrupted by the decussating fibres of the pyramids. The posterior median fissure, however, becomes expanded about the middle of the medulla into the *fourth ventricle.*

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* Crura ad cerebrum. † Crura ad pontem.
‡ Crura ad medullam.

Not only is the structure of the medulla extremely complicated, but different writers use different terms for the same part or attach different meanings to the same term. Only the merest outline will be given here. From before backwards there are on each side (1) the *anterior pyramid*, (2) the *lateral tract* and *olivary body*, (3) the *restiform body*, and (4) the *posterior pyramid* or *funiculus gracilis.* Anteriorly, at the lower end, is seen the *decussation of the pyramids* across the median fissure. The anterior pyramid is formed by the direct pyramidal tract of the spinal cord from the same side and by the (decussating) fibres of the cross pyramidal tract from the lateral column of the other side. The remaining fibres (antero-external) of the anterior column of the cord pass upwards deeply underneath the anterior pyramid to the pons, *en route* for the cerebrum. The remaining fibres of the lateral column of the cord, *i.e.*, exclusive of the crossed pyramidal tract, pass mostly (direct cerebellar tract) backwards to the restiform body and so to the cerebellum, whilst others are continued upward beneath the olivary body * to the floor of the fourth ventricle, formimg the *fasciculus teres* and passing thence to the cerebrum. These latter form the so-called *lateral tract* of the medulla between the anterior pyramid and restiform body. The *restiform body* † is a relatively large prominence, lying between the lateral tract and the posterior pyramid, which merges into the inferior cerebellar peduncle as above noted. By the divergence of the two restiform bodies as they pass upwards to the cerebellum, the space for the fourth ventricle is created. The restiform body is largely a continuation of the fibres of the postero-external column of the cord, but also contains the fibres of the direct cerebellar tract as just mentioned.* The immediate boundary of the posterior fissure is formed by the *posterior pyramid* on each side which, lying along the edge of the restiform body, becomes slightly enlarged (the *clava*) at the apex of the fourth ventricle and then gradually fades away above. It is the upward continuation of the postero-internal column of the cord.† In addition to the longitudinal fibres here described, there are numerous superficial and deep *arcuate* or *commissural fibres* by which the various portions of the medulla inter-communicate. The grey matter of the medulla is partly continued from the spinal cord and partly superadded. Many important nuclei of origin of the cranial nerves are present in the medulla.

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* And arcuate fibres.

† *I.e.*, rope-like.

Fourth Ventricle.—This is the lozenge-shaped space formed by the expansion of the upper end of the central canal of the cord where it reaches the medulla. At its upper end this ventricle passes into the acqueduct of Sylvius, as before described. The lateral boundaries are formed below by the restiform bodies and posterior pyramids of the medulla, and above by the superior peduncles of the cerebellum. The ventricle is divided transversely into two portions, a *superior* (or *anterior*), and an *inferior* (or *posterior*) part, the junction being marked by some white lines crossing the grey matter of the floor and which are known as the *striæ medullares* or (*striæ accusticæ*). The floor of the ventricle is formed by grey matter belonging to the medulla in the lower half and to the pons in the upper. The lower or medullary portion from its resemblance to a nib or pen is commonly called the *calamus scriptorius*. The roof is formed, as in the other ventricles, by pia mater from which a choroid plexus depends, and is pierced by three small openings.‡ Over the superior portion of the fourth ventricle extends the *superior medullary velum* § which is composed chiefly of white matter directly continuous with the cerebellum. In the natural condition this ventricle is concealed from view posteriorly by the cerebellum.

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* The student must be careful to note the different values attached to the term 'restiform body' by different writers, some of whom make it include more, others less, than described above.

† Or 'column of Goll,' or 'funiculus gracilis.'

‡ That one near the central canal being known as the *foramen of Majendie.*

§ Or *Valve of Vieussens.*

THE SPINAL CORD,

The Spinal Cord (or *medulla spinalis*) is the cylindrical elongated continuation of the central nervous system and extends from the lower end of the medulla oblongata to the lower border of the first lumbar vertebra. * It increases in size in two places, viz., where it is joined by the nerves from the upper and lower limbs; these two swellings are known, respectively, as the *cervical* and *lumbar enlargements*. It is partially divided throughout by two fissures—*an anterior median* and a *posterior median fissure*—the former wider and better marked than the latter, but not extending so deeply inwards, whilst another, the *lateral fissure*, indicates the point of junction of the posterior spinal roots. The bottom of the anterior fissuro is formed by transverso connecting white matter, the *anterior* (or *white*) *commissure*; whilst the *posterior* (or *grey*) *commissure* † is situated at tho bottom of the posterior fissure. In the centro of the cord, surrounded by the posterior commissure, is the atrophied *central canal*, continuous above with the fourth ventricle. In structure, the cord, like the other portions of the cerebro-spinal system, is seen to be bilateral. The grey matter, save at the entrance of the nerve roots, is surrounded by white matter and has the appearance of two imperfect crescents united transversely by the grey commissure, so as to roughly resemble the letter H. Each crescent is divided into an interior and a posterior portion constituting the *anterior* and *posterior cornua* of the cord. Tho nerve cells in the grey matter are arranged in definite groups and there are thus formed longitudinal tracts of grey matter rich in cells—the *ganglionic* (or *vesicular*) *columns of the grey matter*. It is practically certain that many of the nerve fibres are directly continuous with the axis-cylinder processes of these cells.

Commissures.—The anterior and posterior commissures are formed of medullated nerve fibres by which tho various portions of the cord are brought into inter-communication, the decussation of the fibres being in all directions and not merely directly transverse. The grey appearance of the posterior commissure is due simply to the presence of 'neuroglia' between the fibres. To the anterior and posterior cornua of each side the corresponding roots of the spinal nerves are attached, the anterior roots being the motor, the posterior the sensory.

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* Its actual termination, of course, is the *filum terminale*, a fibrous cord more or less concealed by tho mass of nerve roots known as the *cauda equina*.

† So-called, *vide* next page.

Columns and Tracts.—By means of the various fissures and the points of entrance of the anterior spinal nerve roots, the white matter of the cord is divided into three main columns, an *anterior column*, a *lateral column*, and a *posterior column*. Experiment and clinical experience show that these columns are sub-divided into various *tracts*, with the general distribution of which the student must familiarise himself. In the anterior column is situated the *direct pyramidal tract* just outside the antero-median fissure. It is not known how this tract ends: probably the fibres all decussate in time through the anterior commissure to the grey matter of the opposite side. In the lateral column posteriorly runs the *crossed* (or *lateral*) *pyramidal tract* * and outside this is the *direct cerebellar tract*. The remaining white matter in these two columns is variously sub-divided but cannot here be further alluded to. The posterior column contains two tracts, the *postero-external* and *postero-internal* respectively.

THE CEREBRO-SPINAL CIRCULATION.

As several very important pathological conditions are intimately associated with injury or disease of the local blood vessels, it is important for the student to remember certain special points in this relation.

Cerebral Arteries.—Four arteries—the two *internal carotids* and two *vertebrals* †—supply the brain with blood. At the base of the brain these unite in an anastomosis known as the *Circle of Willis*. To form this, each internal carotid divides into an *anterior* and *middle cerebral* artery, whilst the *vertebral* arteries join to form the *basilar* artery,‡ which again divides into the two *posterior cerebral* arteries. The circle is completed by the two *posterior communicating* arteries which run from the internal carotids to the posterior cerebrals, and by a very short branch, *the anterior communicating* artery which connects the two anterior cerebrals. The branches of these arteries form two systems—(*a*) *cortical* and (*b*) *central* (or ganglionic). The arteries of these two systems do not anastomose, nor do the central system arteries anastomose with each other—*i.e.*, they are *terminal* and supply definite limited areas; but the cortical arteries do anastomose, though not freely.

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* *Vide ante*, under medulla oblongata.

† From the subclavian arteries. The more direct method by which the blood reaches the brain through the left internal carotid as compared with the right should be remembered.

‡ At the lower border of the pons Varolii.

The branches of the cortical arteries are divisible into two sets—the *long* (or *medullary*) branches which pass well into the white matter, and the *short* (or *cortical*) branches which supply the grey matter of the convolutions. The anterior cerebral supplies the fore-part of the cerebrum on the outer surface, the marginal and adjacent convolutions in front of the parieto-occipital fissure, the quadrate lobe and corpus callosum. The posterior cerebral supplies the lower aspect of the occipital and tempero-sphenoidal lobes and the sensory portion of the internal capsule. The middle cerebral supplies. the rest of the cortex. The central system of arteries is made up of small branches given off from the main vessels, which form six groups—two mesial and four lateral—all terminal arteries. Those which are derived from the middle cerebral—the antero-lateral group, are the most important. They pierce the anterior perforated space and thus reach the corpus striatum, the internal capsule and a portion of the optic thalamus. The largest trunk is known as the *lenticulo-striate* artery * and passes across the internal capsule from the lenticular to the caudate nucleus. Hæmorrhage from the anterior and posterior median groups is very apt to find its way into the ventricles. All these arteries arise directly from large vessels and are therefore extremely liable to rupture under conditions of disease. The pons Varolii and medulla oblongata are supplied by branches from the vertebral, basilar and cerebellar arteries which do not anastomose; hence softening is not uncommon. The converse is true of the cerebellar arteries and softening is correspondingly rare.

The following special points must be carefully borne in mind † :—

(1) The middle cerebral artery supplies the motor region of the brain, both central and cortical, also the cortical auditory centre and visual centre, and all the cortical area concerned in speech.

(2) The anterior cerebral artery supplies only a small part of the motor region, viz., part of the leg centre (paracentral lobule) and the centre for the trunk muscles.

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* Known as the 'artery of cerebral hæmorrhage' from the frequency of its rupture.

† Suckling.

(3) The posterior cerebral artery supplies the sensory portion of the internal capsule.

(4) The region of the ganglia is especially subject to hæmorrhage; the cortical region to softening from obstruction of the vessels.

(5) Obstruction of the artery to the superior tempero-sphenoidal convolution on the left side causes word deafness, the patient being unable to understand what is said to him, though not deaf to sound.

(6) Obstruction of the artery to the left third frontal convolution will cause motor aphasia simply.

Cerebral Veins and Sinuses.—Thrombosis in the cerebral sinuses is by no means rare, but there is free communication between them. On the other hand, the central veins do not anastomose freely and thrombosis occurring in them is, therefore, a serious condition.*

Special points that may be noted † are —

(1) That the veins from the greater part of the cortex pass upwards and forwards into the superior longitudinal sinus, the direction of the current of blood being opposed to that in the sinus. This is one of the chief reasons why clots are readily formed in the sinuses and cortical veins.

(2) That the veins of Galen, which receive blood from the lateral ventricles, empty themselves into the straight sinus. Any obstruction of these veins, as by a tumour of the middle lobe of the cerebellum, causes effusion into the ventricles and constitutes a factor in the production of hydrocephalus; at the same time it is doubtful whether much hydrocephalus can be present unless the communication between the ventricular cavity and the sub-arachnoid space (by means of the foramen of Majendie) is completely occluded.

(3) That nearly all the blood from the cerebrum and cerebellum is conveyed directly or indirectly into the lateral sinuses and thence to the internal jugular veins.

(4) That there are several important communications between the intra-and extra-cranial veins. Thus the veins of the nose and most of those of the scalp communicate with the superior longitudinal sinus; the occipital veins with tho lateral sinus by means of the mastoid veins; the deep cervical veins with the inferior petrosal sinus; while a

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* The hemiplegia that sometimes occurs as a sequel to the specific fevers is considered by some to be caused by thrombosis of the cerebral veins in the cortical motor area.

† Judson Bury.

communication is also established between the facial vein and the cavernous sinus by means of the ophthalmic vein.

PATHS OF CONDUCTION.

It is convenient now to consider briefly the various paths of conduction along which *sensory*, *special sensory* and *motor* impulses pass, with the object of utilising such knowledge in locating disease or injury of the nervous system.

Sensory Path.—The course of the sensory fibres from the point where they enter the posterior spinal nerve roots and pass upwards to reach, ultimately, the cerebellum or cerebrum is by no means thoroughly determined as yet, and it is quite unnecessary to discuss the various hypotheses that exist in regard to this subject. One or two facts however are known. The sensory fibres may be said to begin in the various sensory end-organs and to pass from these in the mixed nerves until they enter the spinal cord by its posterior nerve-roots. They then decussate, at what level is not known, so that the sensory fibres from the right side of the body pass up in the left half of the cord and *vice versâ*. Probably a certain number of the fibres do not so decussate till after leaving the cord and reaching the medulla and pons, but clinically it is found that a destructive lesion of one half of the cord produces loss of sensation (or hemianæsthesia) below the level of the lesion, over the other side of the body. The course taken by the fibres after decussation in the cord is not known with any certainty either. Some hold that they pass up the antero-lateral ascending tract, others that they ascend in the posterior tract,* whilst others consider that the course varies according as the fibres are those of ordinary tactile sensation, or of sensibility to heat, cold, pain, &c. The fibres going to the cerebellum appear to go by the direct cerebellar tract and posterior column of the cord into the restiform body of the medulla and thence to the cerebellum.

The fibres bound for the cerebrum, after decussation for the most part in the cord, pass upwards to the posterior portion of the medulla, any sensory fibres from the posterior columns of the cord which have not previously decussated doing so in the medulla or pons. From the posterior half of the pons the sensory tract is continued into the tegmentum of the crus, thence into the *posterior third of the posterior limb of the internal capsule* between the optic thalamus and lenticular nucleus, to reach finally various portions of the cerebral cortex. The cortical terminations of the sensory fibres are unknown.* Some go to the optic thalamus, some to the occipital region: others, according to Gowers, go to the parietal and central regions.†

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* Gowers considers that the fibres concerned with muscular sensibility (*vide post.*) do not decussate, but pass upwards on the same side, probably in the postero-internal column. Yet others (*e.g.*, Ferrier) are of opinion that the sensory fibres pass upwards in close relation to the grey matter of the cord. In any case the fibres going to the cerebellum, on entrance to the cord, appear to come into relation with 'Clarke's column' in the first instance, so that Clarke's cells form their first terminal station, and then pass as described above (Stirling).

There appears to be decussation of sensory fibres at three portions of the cerebro-spinal system, viz., in the cord, in the medulla and in the pons, the decussation being complete by the time the fibres reach the cerebral peduncle. The posterior third of the hinder segment of the internal capsule was termed the 'sensory crossway' by Charcot: its division or destruction causes hemianæthesia of the opposite side, *including the face*, for the sensory fibres from the face join those from the trunk and limbs, *i.e.*, from the cord, in the pons.‡

Olfactory Path.§—This nerve enters the surface of the brain directly, its outer root fibres going to the uncinate gyrus of that side whilst the remaining fibres decussate (? by the anterior commissure) and pass backwards along the sensory path in the internal capsule to the hippocampal (temporo-sphenoidal) region of the opposite side. When the sensory crossway alluded to above is injured, anosmia of the opposite side results; when the uncinate gyrus is involved, anosmia of the same side results. The explanation of this fact is not known for certain. It may be that the impulses go first to their own side and cross afterwards.*

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* Most of the fibres for ordinary sensation probably go to the occipital and tempero-sphenoidal lobes.

† There certainly seems to be a definite association between the motor areas of the cortex and sensation for, as Gowers says, "disease of the motor cortex often causes impairment of the tactile sensibility, and one commonly sees a sensory 'aura' preceding the epileptiform attacks in cortical disease."

‡ Hence, also, hæmorrhage into the *lower* part of the lateral half of the pons causes facial paralysis of the same side and paralysis of the opposite side of the body, so-called *crossed paralysis*; but if the *upper* part of the lateral half of the pons is involved, the whole of one side of the body is paralysed. (*Vide* also, diagram in Vierordt's *Medical Diagnosis*, fig. 140, page 453.)

§ It must be borne in view that, of the sensory cranial nerves, the olfactory and optic pass directly into the substance of the brain, while the sensory fibres of the trigeminal, auditory, glosso-pharyngeal and pneumogastric nerves enter by means of the medulla oblongata (Gibson and Russell).

Visual Path and Centres.—The Optic Nerves, along which runs the visual path, pass backwards to the optic chiasma where a peculiar decussation of the fibres takes place. The fibres derived from the inner half of each retina cross here to enter the optic tract of the other side, but the fibres from the outer half continue in the optic tract of the same side. The optic tracts then pass backwards and become connected by fibres to the external geniculate bodies, the anterior corpora quadrigemina and the pulvinar of the optic thalami on each side respectively, but the great mass of fibres passes backwards to the occipital lobes, forming the *optic expansion.*† The centre for vision is thus situated in the occipital lobe, but in all probability there is another centre in the angular gyrus. If the occipital cortex is destroyed or any portion of the optic tract between the occipital lobe and chiasma, there ensues blindness of the outer half of the retina on the same side and of the inner half of the retina on the opposite side, so that, *e.g.*, if the right optic tract is injured the person affected would be unable to see anything situated to his left.‡

Auditory Path and Centres.—The Auditory Nerve, directed inwards from the temporal bone, passes between the pons and medulla to end in four nuclei in close relation to the floor of the fourth ventricle. From these nuclei fibres appear to pass, after decussation, some to the cerebellum § and the remainder through the pons and tegmentum to the 'sensory crossway' of the internal capsule and thence to the (superior) temporo-sphenoidal convolution. Destruction of one temporo-sphenoidal region causes only partial deafness on one side ; || if both sides are destroyed complete deafness results. Disease of this region is associated with 'word deafness.' It will be remembered that the middle cerebral artery supplies it.

Gustatory Path and Centres.—The courses taken by the nerves concerned in taste are still disputed, whilst the centre for taste in man is unknown. The nerve of taste for

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* Stirling.

† Or *radiation* (Gratiolet). Some fibres arise in the optic thalamus and pass to the occipital lobe through the internal capsule.

‡ The student should, if possible, refer to the excellent diagrams and accompanying explanations in relation to this subject in Russell and Gibson (*op. cit.* chapter ix).

§ Possibly concerned with equilibration.

|| Apparently the sense of hearing is represented on both sides.

the posterior portion of the tongue is generally stated to be the Glosso-Pharyngeal and for the anterior portion the Chorda Tympani.*

Motor Paths and Centres.—The so-called motor centres in the human brain appear to be situated in the ascending frontal and parietal convolutions (central convolutions), the superior parietal lobule and, along the mesial surface of the hemisphere, in the paracentral lobule and part of the precuneus or quadrate lobule. The region thus included has been named the *psychomotor* or *motor cortical area.* As has been noted before, it is commonly considered now that this area is not exclusively motor, but has a more or less intimate relation to the different sensory areas. The *leg centre* for the opposite side of the body appears to occupy the upper one-third of the area, the *arm* the middle third, and the *face* the lower one-third, the lowest portion of the ascending parietal convolution being the area for the movements of the *lips* and *tongue.* The *speech centre* occupies the last-named area in the left hemisphere and also the posterior end of the third left frontal convolution.† There are, probably, other centres in adjacent parts of the cortex, but these have not been located as yet with any certainty.‡

Stimulation of these centres, *e.g.*, in irritative lesions of the brain, causes convulsive movements; their destruction, through pressure or otherwise, causes paralysis. From these centres nerve fibres pass through the white substance of the hemisphere, forming part of the *corona radiata*, to the internal capsule. Here they occupy the knee and anterior two-thirds of the posterior limb of the capsule, the fibres for the face and tongue being situated in the knee, those for the arm in the anterior third, and those for the leg in the middle third, adjacent to the sensory portion of the capsule. They then pass under the optic thalamus into the crusta of the cerebral peduncle occupying its middle third or so, the fibres for the leg outermost, those for the arm next, and those for the face nearest the middle line. Thence they go to the pons, at which spot the fibres for the face and tongue decussate to reach the nuclei of origin of the hypoglossal and facial nerves, whilst the fibres for the upper and lower limbs pass on to the medulla and form, as, before described, the *pyramidal tracts* in the medulla and spinal cord.

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* Gowers believes that taste impressions reach the brain solely by the roots of the fifth nerve. He admits that the chorda tympani is the nerve of taste for the anterior two-thirds of the tongue, but considers that it reaches the facial nerve from the spheno-palatine ganglion through the vidian nerve, whilst the nerve of taste to the posterior one-third, though possibly distributed with the glosso-pharyngeal nerves, reaches it through the optic ganglion by the small superficial petrosal and tympanic plexuses.

† Possibly, also, the Island of Reil.

‡ The centre for movement of the muscles of the *trunk* would appear to be situated in the mesial or inner aspect of the ascending frontal convolution in close relation to the leg centre. "Movements in both sides of the body following upon excitation of one hemisphere are common, but many of these movements cannot be claimed as examples of strictly bilateral representation in the cortex. The movements of the trunk (rectus abdominis, &c.,) tongue turning the head and conjugate deviation of the eye balls are often classed as such, but in reality they are not so. The movements of pouting the lips, mastication, swallowing, movements of the soft palate and adduction of the vocal cords seem to be truly bilateral movements. We may, therefore, assert as a general proposition that the muscles of one lateral half of the body are regulated by certain areas in the opposite cerebral hemisphere, except in the case of bilateral muscles usually acting together" (Stirling).

The *cranial* motor paths or tracts from the cortical centres leave the pyramidal tracts at intervals in the pons and medulla, then decussate and finally end in the grey nuclei of these structures from whence originate the motor cranial nerves. Similarly the fibres of the pyramidal tract in the *cord* pass, at different levels, to the grey matter in the neighbourhood of the ganglionic cells in the anterior cornua from whence arise the anterior or motor nerve roots for distribution to the trunk and limbs. The cortical centres are centres for voluntary motion: the spinal centres not only receive the stimuli from these centres and pass them on to the motor nerves, but are also *reflex* centres which are excited by peripheral stimuli received from the sensory or posterior spinal roots and transform these into motor stimuli. It is therefore convenient clinically to divide the motor path into an *upper* and *lower segment*, of which the upper extends from the cortical centres up to the bulbar nuclei and anterior cornua, whilst the lower includes the bulbar and spinal centres and extends to the peripheral terminations of the motor nerves. The cortical centres exercise a nutritional or *trophic* influence over the upper segment, the bulbar and spinal centres exert the same in regard to the lower segment. If any portion of the upper segment is destroyed, *e.g.*, by pressure of a tumour, hæmorrhage, &c., a spastic paralysis results, *i.e.*, there is paralysis of the muscles concerned, with rigidity or spasm, and the fibres of the pyramidal tract below the lesion degenerate * as far as the bulbar and spinal centres, but these latter and the peripheral nerves and muscles remain unaffected in regard to nutrition owing to the above-mentioned trophic influence.

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* Degenerations of the *motor* tracts are *descending*, degenerations of the *sensory* tracts *ascending*.

The *situation* of the lesion is indicated more or less definitely by peculiarities in the distribution of the paralysis, of which the following are the chief * :—

1. If the lesion is *above the decussation* of the pyramids, the limbs and trunks muscles are paralysed on the opposite side of the body. (*a*) If it is situated above the middle of the pons, the opposite side of the face may also be paralysed.† (*b*) If below the middle of the pons, the face is paralysed on the same side as, but the limbs on side opposite to, the lesion—crossed paralysis or 'alternate' hemiplegia. (*c*) When the lesion involves the anterior pyramid of the medulla, the face remains unaffected.‡ (*d*) Irritative lesions of the cortical centres cause convulsions, destructive lesions paralysis, on the opposite side and, owing to the divergence of the motor fibres as they approach the cortex and the consequent separation of those belonging to the face, arm and leg, respectively, the paralysis is often limited to the face or to one limb—*Monoplegia.* The convulsions, too, of an irritative lesion are usually limited at first to a few muscles of the opposite side of the face or of the opposite limb.

2. If the lesion is *below the decussation* of the pyramids, *i.e.*, is situated in some part of the pyramidal tract in the spinal cord, the limbs and trunk are paralysed on the same side. As a rule, in the cord both tracts are affected and hence both sides of the body are paralysed; in such cases the grey matter rarely escapes injury, and so modifications of sensation or of the reflexes usually accompany a spastic paralysis of spinal origin.

The following points should also be carefully remembered:—

A local disease at the base of the brain injures the cranial nerves which go off from that point. If it is located in the anterior cranial fossa, the olfactory nerve will be affected; if in the middle fossa it may cause disease of the optic, oculo-motor, trochlear or abducent nerves; sometimes, also, of the olfactory. If in the posterior fossa, the trochlear, abducent, facial, auditory, glosso-pharyngeal, vagus and spinal accessory nerves may severally or collectively suffer. Bilateral affection of the nerves may occur. From simultaneous injury to the crus cerebri, pons and medulla, the pyramidal tracts may become affected and paralysis of the extremities result; but in basilar affections paralysis of the cranial nerves is generally the more marked sequel.*

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* Judson Bury.

† *Vide* foot-note, p. 97.

‡ It must be remembered that lesions in the medulla or pons are very apt to involve vital centres such as those for respiration, cardiac action and so on, and in such a case death may result slowly or almost immediately.

Motor Paths and Centres for Speech.—These have already been alluded to in various places, but a little more detail is of importance. The motor centres for the organs of speech have been located in the third left frontal convolution, and probably also in the Island of Reil, and here also the "psychical processes in the act of speech are completed." In most persons, the centres are in the left hemisphere, but in left-handed people they are almost certainly situated in the right hemisphere. The motor tract for speech runs along the upper edge of the Island of Reil, then internal to the posterior edge of the genu of the internal capsule through the crusta of the left cerebral peduncle into the left half of the pons, where it *crosses*, and thence to the medulla, which is the place where all the motor nerves—trigeminal, facial, hypoglossal, pneumogastric and respiratory—concerned in speech arise. Total destruction of these paths causes total *aphasia*—partial destruction results in a greater or less disturbance of the mechanism of articulation (*anarthria*).†

CHAPTER X.

CLINICAL EXAMINATION OF THE NERVOUS SYSTEM.

In by far the larger number of cases of nervous disease it is impossible to detect the site of disease by direct physical examination, (*a*) because the symptoms are frequently manifested at places distant from the seat of disease; (*b*) because the brain and spinal cord are protected from inspection, &c., by their rigid covering of bone; (*c*) because the local injury or disease, though causing very distinct nervous phenomena, may be so apparently slight as to be unlocated during life and even after death. In certain cases, *e.g.*, hydrocephalus, rickets, congenital idiocy, syphilis, malignant disease, meningitis, spinal curvature, leprosy, neuromata, &c., there may be local conditions detectable which point to direct involvement of corresponding portions of the cerebro-spinal nervous system, but, exclusive of these, there exists the large body of typical nervous diseases where any examination of the site of lesion is precluded during life. On the other hand, owing to our increased knowledge of the topography of this system, coupled with the advance of aseptic surgery, it is steadily becoming more possible to 'localise' the seat of lesion in certain nervous diseases and, in suitable cases, to operate with a view to removal of pressure due to bone, neoplasms, accumulations of pus, &c. The consideration of this branch of the subject, however, belongs to larger works and more extended experience. For the present the student must confine himself to the examination of the nervous system as outlined in the case scheme in Chapter II.

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* Vierordt. The student should read this paragraph with a diagram of the relations of the cranial nerves at the base of the skull before him.

† *Vide* Chapter X.

SENSORY FUNCTIONS.

Disordered sensation may result from injury or disease of any portion of the sensory apparatus, whether end organ, nerve fibre or ganglonic centre. The phenomena thus produced are sometimes divided into *subjective* and *objective*, a convenient, though not strictly scientific, arrangement. It will be found, however, that accurate knowledge of the nervous system is still so deficient in many directions that writers are obliged to resort to a more or less artifical classification of the subject. By subjective sensations, then, are meant those which are independent of external stimuli,* by objective those dependent on some form of applied stimulus, and it is evident that pain is included under both headings.

Subjective Sensations :
  (1) Presence of pain without external stimulus.
  (2) Presence of perverted sensations—*paræsthesia*.
Objective Sensations :
  (1) Exalted sensibility—*hyperæsthesia* (*hyperalgesia*).
  (2) Lowered sensibility—*anæsthesia* (*analgesia*).
  (3) Accelerated or retarded sensory perception.

Subjective Sensations.—Wherever the common sensibility is exaggerated sufficiently pain results. The pain occurring in the course or distribution of the affected nerve is termed *neuralgia*. It is of very varied character and is described in different cases as burning, darting, shooting, intermittent, &c. Frequently it is much increased by movement and appears to go in 'waves' or 'throbs.' When the nerve is accessible to touch it is found to be tender on pressure being made. There are very many forms of neuralgia of which the following are the chief:—

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* *I.e.*, stimuli applied directly by the examiner. Pain, of course, is always due to a stimulus of some kind, *e.g.*, a cold wind, a carious tooth, or even the imagination, but that is different from the intentional stimulus produced by pinching, pricking, the electric current, &c.

(1) Neuralgia of the trigeminus or *tic doloreux*. The fifth nerve as a whole, or some of its branches, are affected and it is generally possible to detect tender points at the foramina of exit of the branches; (2) occipital neuralgia; (3) intercostal neuralgia*; (4) sciatica, where the pain follows the course of the sciatic nerve from the sciatic notch downwards, even to the heel; (5) visceral neuralgia, *e.g.*, of the stomach, rectum, uterus, ovaries, &c.; (6) neuralgia of the various plexuses, *e.g.*, brachial, lumbar. The latter must be distinguished from bone and joint affections, renal colic, lumbago, &c. In investigating pain which may be neuralgic it is especially important to notice its distribution, the points where pressure is painful, and whether it is paroxysmal or not; though many other forms of pain are paroxysmal also.

Certain forms of pain are more or less characteristic of special diseases. Among such are the *girdle pains* and *lightning pains* of locomotor ataxia, resulting from disease of the posterior nerve roots and the sensory tracts in the cord. Headache is another form of pain which may or may not be associated with general nervous disease. The pain varies in different cases in regard to its site, mode of invasion and intensity. Many so-called headaches are in reality forms of neuralgia, *i.e.*, are caused by irritation of the nerve trunks. True headaches, as a rule, are defined as due to 'diffuse irritations located in or referred to the peripheral ends' of the trigeminus, upper cervical, and sensory filaments of the vagus. Careful investigation of the three points mentioned above may yield very valuable information for diagnosis and treatment.

The abnormal sensations, *paræsthesiæ*, which may be experienced are more or less included under the following headings:—

(1) Abnormal sensations, tactile, painful, thermal.
(2) Perverted cutaneous sensations.

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* To be distinguished carefully from rheumatic, syphilitic, and neuritic pain.

Various tactile paræsthesiæ are found in locomotor ataxia, peripheral neuritis and other diseases, of which the commonest are *formication* or a feeling as if ants are crawling over the skin; pain of a stinging or pricking character; sensations of heat and cold, frequently alternating. All these may be temporarily experienced after pressure on a nerve trunk, *e.g.*, the sciatic, when one's leg is said to have 'gone to sleep'; but when persistent they betoken serious disease. *Numbness* is a very constant symptom in commencing nervous disease: the patient states that he feels as if walking upon a thick carpet, or that his legs feel like wood or as if they were dead. When the special senses are affected, giddiness or *vertigo* may result from want of harmony between, for example, the impressions received from sight and hearing. Sometimes pain is experienced when a part is simply touched or, conversely, a sharp prick feels simply like a gentle touch, or the application of cold may produce a sensation of stinging pain. In other cases when one point is touched the patient feels as if several places were touched—*polyæsthesia*, or the patient touched on one side may refer the feeling to the other side of the body—*allocheiria*. Such perversions are on the border-land between subjective and objective.

Objective Sensations.—The student has to enlist the co-operation of the patient in enquiring into these, and it follows as a corollary that, since the personal factor enters largely into the case, extreme caution must be exercised in regard to checking the value of the answers given.* He must be directed to close his eyes and to *keep them closed*, saying 'Yes' as soon as he feels anything. Sometimes several examinations are necessary before a stupid ryot or cooly even begins to understand what is wanted. Corresponding points on the two sides of the body must be carefully compared. Cutaneous sensibility, sensations of pressure, of pain, of temperature, and of locality have to be investigated, as well as the so-called muscular sense.

Cutaneous Sensibility is generally tested by touching the skin in different places very lightly with the head of a pin or with a feather.† Sensibility to Pain is tested by gently pricking the skin with the point of a pin or, in cases where there is much loss, by actual pinching of a fold of skin. The Sense of Pressure is sometimes tested by means of a special instrument, the 'baræsthesiometer,' or by means of different weights placed over the skin. Considerable practice is necessary to obtain accurate results. The Sense of Temperature is estimated by means of two similar test tubes filled respectively, with warm and cold water. A difference of not less than 2° F. can be appreciated anywhere over the body surface in health. The Sense of Locality is commonly examined into by making the patient indicate (with eyes closed) the exact spot touched: in health he will make no appreciable mistake. An instrument termed the 'æsthesiometer,' for denoting the exact distance at which its two points are recognised as two, is sometimes used.* In this case the 'pressure factor' is a very variable quantity. Diminished sensibility is termed *anæsthesia;* † increased sensibility *hyperæsthesia*, and, when necessary, a qualifying term may be used such as *thermal anæsthesia*, *tactile hyperæsthesia*, &c. The rapidity of sensory conduction is very much lessened in some diseases, *e.g.*, locomotor ataxia, and whereas in health the reply of the patient is almost instantaneous with the act of pricking, in disease the answer may be delayed even for several seconds.

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* The practised malingerer who has carefully studied locomotor ataxia or some other disease in a book beforehand may easily mislead a careless examiner. Quite lately the writer had a patient who simulated the ataxic gait, anæsthesia and other symptoms of locomotor ataxia with wonderful accuracy.

† The use of the faradic current is recommended by some.

The muscular sense is in reality a 'generic' name for a series of sensations. It has been defined as 'that collection of impressions by means of which the mind is enabled to appreciate the degree of contraction of the muscles.' The two methods of investigation comprise (1) the estimation of different weights,‡ (2) the recognition of posture. The first can be examined into by taking small bags or balls, of different weights but strictly similar in appearance, suspended in a towel, and hanging them on the hands and feet, &c. A healthy person will recognise differences of one-tenth. The second point may be tested by directing the patient with his eyes closed to put himself into a definite position, to touch the tip of his right ear with his left hand or the left patella with his right big toe, &c.; or else the observer may move the patient's limb in various ways and then direct him to describe its final posture.

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* Or a pair of compasses; the distance being measured on a scale.

† Sometimes, more correctly, hypæsthesia; anæsthesia being reserved for complete loss, but one can always say 'slight,' 'marked' or 'complete' anæsthesia.

‡ The 'dynamic sense' of some authors.

Concluding remarks.—The conclusions which may be drawn from the foregoing examination are of great interest, but want of space forbids more than a few remarks. The degree or kind of anæsthesia is not so important as its *distribution.* In hysteria the anæsthesia is more often complete over a part of limb than in organic disease and, in addition, may not correspond to the anatomical distribution of the nerves. *Paranæsthesia*[*]—impaired sensation over the lower half of the body, implies a spinal lesion, is frequently found along with paraplegia and, by its upward extent, indicates the level of the lesion in the cord. *Hemianæsthesia*[†]—unilateral impairment of cutaneous sensibility, when extending from head to foot, implies a lesion in the opposite side of the brain. When accompanied with impairment of the special senses the lesion is most frequently situated in the sensory part of the internal capsule. It is associated with hemianopsia. When sight and smell are unaffected the region between the internal capsule and pons is involved. When the face is unaffected or is affected on the opposite side of the body to the limbs the lesion is in the pons or medulla. As a rule in an ordinary hemiplegia the anæsthesia is slight and transient. When the reverse is the case the motor disturbance is generally small. Limited anæsthesia is seen in paralysis due to cortical disease, in tumours or caries of the spine and in peripheral neuritis. In this latter connection it is important to remember that the motor fibres of a mixed nerve are much more easily affected by pressure, &c., than the sensory ones.

General hyperæsthesia is rare: it is seen in hysteria, hydrophobia, syphilis and occasionally in lesions of the pons. Local hyperæsthetic spots are common in hysteria, spinal disease, neuralgia, &c. Very frequently the upper limit of a spinal lesion is indicated by a hyperæsthetic band round the body and may be detected by pinching or by passing a sponge dipped in hot water along the spine—'sponge test.' Paræsthesiæ may occur from disease of any part of the sensory tract but are specially common in locomotor ataxia. Finally, the student should note that in disease of the cerebral cortex the cutaneous sensibility may give normal results to the ordinary tests, but the patient may be unable to recognise (by feel) the nature of objects placed in his hand or to tell accurately the position of the affected limb.[‡]

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[*] The 'dynamic sense' of some authors.

[†] *Cf. paraplegia, hemiplegia.*

[‡] Judson Bury.

SPECIAL SENSES.

Vision.—A mere enumeration of the various disorders of vision would occupy considerable space; hence larger works must be consulted.[*] In all cases of nervous disease the visual apparatus should be examined. Atrophy of the optic nerve is either primary or secondary. In the latter case it follows severe optic neuritis or embolism of the central retinal artery. In the former it results from pressure on some part of the nerve or chiasma, or is a consequence of chronic sclerosis of the nerve fibres. It is especially common in locomotor ataxia and may precede all other symptoms; it is also common in multiple sclerosis.

Hearing.[†]—In by far the larger number of cases deafness is due to disease of the outer or middle ear. In nervous cases the existence of such a condition should be examined into in the first instance. Subjective sensations of 'humming,' 'ringing' or 'beating' noises—called collectively *tinnitus aurium*, are very common and are caused by anæmia; by certain drugs, such as salicylate of soda or quinine, which affect the circulation; by local disease, such as disease of the inner ear, the auditory nerve or the cerebral centres. In some cases tinnitus or deafness co-exist with vertigo, a condition explained by the fact that the nerve fibres concerned with sound impressions and equilibration run together for some distance. In the brain, however, these fibres separate to go to different centres and thus, when subjective sensations of hearing result from central brain disease, we find that "where the auditory centre is affected we have tinnitus or deafness and no giddiness, whereas, when the affection is in the cerebellum, the conditions are reversed" and there is giddiness but no deafness.

Taste.—As before mentioned,[‡] there is still some doubt as to the source of the nerve fibres concerned in taste. The anterior two-thirds of the tongue are supplied by the chorda tympani, the fibres coming from the lingual. The posterior one-third is supplied by the glosso-pharyngeal, according to some, whilst others affirm that the taste fibres are in reality derived from the fifth *viâ* the otic ganglion.

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[*] The student should study the method of examination of the eye as detailed in Gibson and Russell's *Physical Diagnosis*—*Vide* also Chapter XV.

[†] The method of examination of the hearing will be found in Chapter XIII.

[‡] *Vide* Chapter IX.

Sweet, bitter and acid substances are used for testing this sense; syrup, solution of quinine and dilute acetic acid are suitable and are applied by means of a glass rod. Sweet substances are best appreciated at the tip and edges, bitter at the root, of the tongue. *Anæsthesia of taste*,[*] *i.e.*, loss or diminution, is met with in hemianæsthesia. Lesions of the glosso-pharyngeal will affect the posterior portion of the tongue.[†] When the anterior two-thirds are affected, the fibres of the lingual are involved. The following considerations will help in the diagnosis of the lesion: (1) if the taste is thus lost along with loss of ordinary tactile sensation in the tongue, and without other indications of affection of the fifth nerve, then the lesion is in the lingual; (2) when the chorda tympani is alone affected, taste is lost in the anterior two-thirds of the tongue without tactile sensations being affected;[‡] (3) where facial paralysis accompanies the loss of taste, then the lesion is situate on the nerve between the geniculate ganglion and the point at which the chorda tympani leaves the nerve; (4) when symptoms of affection of the second division of the fifth nerve accompany the loss of taste, the lesion lies on the nerve tract, between the sphenopalatine and gasserian ganglia; (5) when the loss of taste is accompanied by total anæsthesia over the region supplied by the fifth nerve, the lesion lies at the root of that nerve at the base of the skull.[§] *Parageusiæ*, *i.e.*, perversions of taste, or *hypergeusiæ*, subjective taste sensations, are met with as constituting the aura of an epileptic attack, in ear disease, hysteria and insanity.

Smell.—Anything which prevents the particles of odorous matter reaching the olfactory end-organ will produce *anosmia* or loss of smell. Many purely local or surgical conditions will do this, and such conditions must, therefore, be carefully excluded in the first instance. The sense of smell is commonly tested by making the patient inhale the odour of musk, valerian, aromatic oils, &c., but *not pungent odours* such as ammonia or acetic acid. Anosmia may be congenital or may occur in old age, in paralysis of the fifth[‖] or seventh nerves, thrombosis or embolism of the anterior cerebral artery, disease of any portion of the olfactory apparatus and in locomotor ataxia. *Hyperosmia* and *parosmia* occur in hysteria, insanity and as an epileptic aura.

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[*] Called also *ageusis*.

[†] It is said that lesions of the root of the fifth have produced hemianæsthesia of taste of the corresponding sides of tongue and palate.

[‡] Often occurs in middle-ear disease.

[§] Graham Browne.

[‖] Which causes excessive dryness of the mucous membrane.

MOTOR FUNCTIONS.

These may be inquired into in various ways, but the following will be found as good as any :—

1. Visceral motor functions.
2. Voluntary motor functions.
3. Vaso-motor functions.*

Visceral Motor Functions.—Sometimes called the 'organic reflexes.' But little is known as yet of the movements of the viscera that is of diagnostic value. The centres for the contraction of the œsophagus during deglutition and the centre for respiration are both situate in the medulla near other important vital centres, † and either or both may become involved in advanced bulbar paralysis with a necessarily fatal result. The centres for defæcation (ano-spinal) and micturition (vesico-spinal) are placed in the lumbar enlargement of the cord and are normally under voluntary (cerebral) control. They are also reflex centres, however, and if, therefore, voluntary impulses are unable to reach them owing to spinal disease at a level above them, they are stimulated from time to time by sensory reflex impulses when the rectum or bladder becomes filled, these viscera being emptied by contractions the result of reflex motor stimuli. If the sensory tracts are involved the patient voids his urine or fæces quite unconsciously. If the centres themselves are involved incontinence ‡ of urine and fæces results. The sexual centres (erection—ejaculation centres) are situated in the same region and governed by much the same conditions. When they are involved in the disease sexual power is destroyed. The examination into the condition of the lumbar centres is obviously made partly by questions put directly to the patient, and partly by actual observations on the part of the attendants. The condition of the sphincter ani should also be inquired into by digital examination. So long as the ano-spinal centre itself is unaffected the introduction of the finger results in a momentary relaxation of the sphincter followed by tonic § contractions : when the centre is destroyed there is passing contraction of the sphincter (local stimulation) followed by permanent relaxation.

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* Included here for convenience.

† *Vide* Chapter IX.

‡ So-called 'paralytic' incontinence. In spinal disease *above* the centres 'intermittent' incontinence of urine may occur. It results from the fact that any sudden pressure on the bladder or movement may cause the bladder to expel the urine. In time the *detrusor vesicæ* muscle may become paralysed and then retention of urine results, with 'overflow' incontinence, a very serious condition of things generally ending in cystitis and renal complications.

§ *Vide* next page.

Motor Functions of Voluntary Muscles.—The *nutrition* of the muscles will be noticed under trophic functions.* The *tonicity* (tension) of a muscle may be estimated by manual feel: a flaccid muscle feels softer than normal when pinched, a rigid muscle harder. Flaccidity occurs when there is wasting and is well seen when the anterior cornua of the cord are involved.† When rigidity is well marked the term *contracture* is applied to it. Clinically two forms of contracture are recognised, viz., active and passive. The latter is seen when a limb is from any cause, such as joint disease, maintained in a fixed position, or as a sequela to inflammation or degeneration. It is almost impossible to straighten the limb and the attempt to do so causes great pain. Not only so, but the limb if straightened generally becomes slowly bent once more. Active contracture results from the irritation, direct or indirect (reflex), of motor nerve fibres. It is commonly seen in descending degenerations following hemiplegia, &c., but is not unknown in hysteria. In hemiplegia the active contraction consequent on irritation and degeneration of the motor fibres is divided into 'initial,' 'early,' and 'late' rigidity according to its duration. The last named in persistent paralysis passes into 'structural' rigidity (passive contraction). Active contraction permits of the limb being temporarily straightened without pain and disappears during sleep and under chloroform.

As with sensation so with muscular action, it may be *increased*, *diminished* or *perverted*.

Increased Muscular Action.—This may occur in voluntary or involuntary muscular tissue and independent of voluntary stimulus. It is then designated *spasm* ‡ and indicates a morbid condition either of the muscles or of their governing nerve tracts. Continued spasm is termed *tonic:* where there are rapid alternations of contraction and relaxation it is called *clonic*.

The rigidity or contracture mentioned above, with the exception of late structural rigidity, are in reality examples of persistent tonic spasm, but, apart from such extreme conditions, examples of true tonic spasm are seen typically in cases of cramp (from whatever cause, cholera, over-exertion, cold, &c.),

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* *Vide* p. 125.

† *E.g.*, in pseudo-hypertrophic (Duchenne's) paralysis.

‡ Or *hyperkinesis*.

tetanus, torticollis, hydrophobia, &c. Very often the cause of an attack of tonic spasm may be abundantly clear, but in some cases, *e.g.*, torticollis or wry-neck, the source of irritation is hardly discernible. When tonic spasm is associated with paralysis we get a condition of spastic paralysis.

Under clonic spasm are included all the forms of interrupted spasm, from the slightest form of tremor to wild convulsion. One of the earliest signs of muscular atrophy is a slight wavy movement of the muscle fibres beneath the skin, known as *fibrillary contraction* or *tremor*. It is best seen in progressive muscular atrophy, but occurs also in infantile paralysis and peripheral neuritis. When the tremor is more pronounced and affects a larger area it results in movements of the fingers, limb, head or trunk. These movements vary much in degree and in their other character. They are seen in paralysis agitans, disseminated sclerosis, old age (senile tremors), in ex-ophthalmic goitre, in alcoholic, lead and mercurial poisoning and in hysteria. The student should be very careful to note the characters of the tremor present in a given case, the distribution, the effect of voluntary motion, rest, sleep, &c., in increasing or lessening its occurrence, as such points are frequently of great diagnostic importance.

The remaining form of clonic spasm, viz., *convulsion*, can only be briefly attended to. It has been described as the 'result of a discharge of energy from the cells of the cerebral cortex, and hence it indicates an instability of these cells'—a sufficiently vague definition—and the instability may be brought about by varying groups of causes:—(1) local disease, *e.g.*, meningitis, cortical tumour; (2) blood changes; (*a*) pyrexia, *e.g.*, sun-stroke, (*b*) a hyper-venous condition of the blood or poisonous substances circulating in the blood, *e.g.*, congenital heart disease, uræmia, puerperal septicæmia; (3) reflex causes, *e.g.*, ascarides, volvulus; (4) unknown causes, *e.g.*, in hysteria and some cases of epilepsy. The recurrent convulsions which are specially characteristic of septicæmia or uræmia are sometimes termed *eclampsia*. A peculiar form of convulsion is the local form, termed also 'Jacksonian epilepsy,'* and generally caused by irritation of the cortical motor area through pressure, &c. It is very often the precursor of paralysis following on increased pressure in the same region. It is highly important for the student to note, if possible, the initial spasm in such a case, *i.e.*, whether it begins in the right hand or the left toe, &c., because information on this point may afford valuable evidence in locating the disease. *Chorea* is a condition commonly seen in children and supposed to be associated with the rheumatic diathesis, in which there occur constant 'twitchings' or clonic spasm of the muscles of the face and limbs. They are specially well seen when the tongue is protruded, that organ being pushed out and drawn in and moved rapidly from side to side. The movement can be checked by voluntary effort. *Athetosis* is the term applied to a rare condition in which there is seen slow rhythmic movements of the fingers or toes, &c., on one or both sides, *e.g.*, they may be slowly flexed, then slowly extended. Similar movements may occur in advanced hemiplegia.

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* After Hughlings Jackson.

Diminished Muscular Action.—When the power of a voluntary muscle is impaired or lost the term *paralysis** is applied to the condition. The student has first to enquire into the *degree* and *distribution* of the paralysis and then into the *nutrition* and *tone* of the muscles involved. Various terms are made use of in denoting the distribution of a paralysis, of which the more important are (*a*) *hemiplegia*, paralysis of one side of the body; (*b*) *monoplegia,* paralysis of one limb or of one half of the face; (*c*) *paraplegia*, inferior or superior according as the lower or the upper limbs are paralysed; (*d*) *hemiplegia alternans*, paralysis of the limbs on one side and of the face on the other side; † called also 'crossed paralysis.'

In commencing the examination of a paralysed patient the first thing to be ascertained is whether he is able to perform all the ordinary movements, such as walking, standing upright, bending his body; flexing, extending, rotating his limbs; nodding, and turning the head, &c. Having settled these points the examiner should direct particular attention to the part that is obviously affected; *e.g.*, if the facial muscles, he should direct the patient to whistle, to eat something, to close and open his eyes, to grin, put his tongue out, &c.; if the limbs, he should direct him to make certain definite movements to test each muscle in turn, whilst the examiner offers a varying amount of resistence if necessary. In conducting such an examination the student requires a good knowledge of anatomy and the exercise of common sense.

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* Or *akinesis*. *Paresis* (*hypokinesis*) is sometimes used to denote partial paralysis, but is wanting in exactness, since all degrees of weakness are seen. The same objection applies to the term *hypæsthesia* in regard to sensation.

† *I.e.*, of the facial or other cranial nerve.

The important thing is to proceed on a *definite plan*, *e.g.*, in the arm, to test the biceps, triceps, deltoid and other upper arm muscles, then the forearm muscles and, lastly, the muscles of the hand. The *dynamometer* is an instrument intended to indicate the exact amount of muscular weakness by means of a dial connected with a spring that is grasped by the hand, but it is not a satisfactory instrument and much more accurate information may be obtained by the examiner himself testing the 'grasp' of either hand of the patient.

The tone of the muscle has been already alluded to and the nutrition will be afterwards noticed. It must suffice here to mention that, *broadly speaking*, cases of paralysis may be divided into two great groups without regard to distribution, viz., (*a*) *the atrophic paralyses*, in which there is weakness combined with the wasting of muscular tissue, the lesion being situate in some portion of the *lower* segment of the motor tract; * (*b*) the *spastic paralyses*, in which there is weakness combined with rigidity of the muscles, the lesion being situate in some portion of the *upper* segment of the motor tract.†

The *size* of muscles may be estimated by comparing them with corresponding muscles on the opposite side of the body and by accurate measurement with a tape. Increased size is due to continued use: apparent increase in bulk is seen in pseudo-hypertrophic paralysis. Decrease in size is due to disuse, *e.g.*, the result of fixation of a limb from injury or disease, or is consequent on disease of the motor nerves, the anterior nerve roots or the anterior cornua. In the last case the wasting may be very marked.

Functional paralysis, as opposed to organic, is not unknown in hysterical subjects and, apart from other positive signs of hysteria, the diagnosis is generally easy owing to the absence of 'trophic' and 'electric reaction' changes, and to the increase instead of the diminution of the reflexes.

Disorders of Reflex Action.—The student will remember the definition of a reflex action as given in physiology and the various structures that must be in working order to form a reflex loop. Certain spinal reflexes have already been mentioned,‡ but there remain to be inquired into the superficial reflexes, cutaneous, and cranial, and the deep reflexes. The following are the *cutaneous* reflexes most commonly made use of:—

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* *Vide* Chapter IX.

† Judson Bury (after Ross).

‡ *Vide* 'organic' reflexes.

Name of reflex.	Mode of excitation.	Nature of result.	Level of cord upon which reflex depends.
Plantar	Stroking side of foot	Movements of toes; of these and foot; or of these and leg.	Second sacral nerve (lower part of lumbar enlargement).
Gluteal	Stroking skin of buttock ... (Rarely present in health).	Contraction of glutei	Fourth and fifth lumbar nerves.
Cremasteric ...	Stimulation of skin at upper and inner part of thigh.	Retraction of testicle	First and second lumbar nerves.
Abdominal ...	Stroking abdominal walls downwards from costal margin in nipple line. (May be absent in health.)	Contraction of upper or of lower portion of abdominal muscles.	Eighth to twelfth dorsal nerves.
Epigastric ...	Stroking side of chest downwards from nipple. (May be absent in health.)	A dimpling of corresponding side of the epigastrium.	Fourth to sixth or seventh dorsal nerves.
Interscapular ...	Irritation of interscapular region. (Rarely present in health.)	Contraction of scapular muscles and of portion of axillary fold.	Sixth cervical to second dorsal nerve.

A good deal of practice is necessary before deductions of much value can be made from an investigation into the condition of these reflexes, and the student is, therefore, advised to practise those that are suitable in every possible case, in children and adults of both sexes, diseased and healthy. He will find that the degree of response to the stimulus varies very much even in healthy persons, children giving the best marked results, women less and men least.*

The diagnostic value of these reflexes may be estimated by remembering (1) that a normal response shows the reflex loop to be in proper working order and under control; (2) that increase or exaggeration suggests irritation of some portion of the loop or that it is cut off from the control of the cerebral centres, *e.g.*, in strychnine poisoning, tetanus, &c., affecting the grey matter of the cord, in pachymeningitis, from irritation of the spinal nerve roots, in transverse myelitis above the level of the reflex, from interference with cerebral control ; † and (3) that loss of or diminution ‡ in the reflex points to disease affecting some portion of the loop, such as the nerves, nerve roots or grey matter of the cord, or to increase in the cerebral reflex-inhibitory action, resulting from cerebral irritation, as seen in organic paralysis.§

The *cranial* reflexes, as they are termed by Ross, are the following : (*a*) winking or closure of the eyelids produced by irritation of the conjunctiva or by the sudden movement of an object ; (*b*) contraction of the iris to light ; (*c*) sneezing or lachrymation from irritation of the nasal mucous membrane ; (*d*) contraction of the palate from irritation of the fauces ; (*e*) coughing from irritation of the larynx ; (*f*) contraction of the facial muscles from irritation of the fifth nerve or from a loud noise. The Argyle-Robertson symptom is the name given to a condition commonly found in locomotor ataxia in which the pupil fails to react to light, but contracts or dilates for accommodation, showing that the reflex action is lost whilst the associated movement remains. It is looked for by trying the patient's accommodation for near and distant objects, and by closing his eyes with the hands—*without pressure* on the eye-ball, and suddenly removing the hands.* Paralysis of the iris is termed *iridoplegia* and there are three varieties: *reflex iridoplegia*, noted above; *loss of skin reflex*, in which case pinching or faradisation of the skin of the neck fails to produce dilation of the pupil (disease of cervical spinal cord or cervical sympathetic); and *accommodation iridoplegia*, common in diphtheritic paralysis. The palatal or pharyngeal reflex is usually abolished in bulbar paralysis.

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* Aged male adults frequently show no cremasteric reflex, and the abdominal reflex is difficult to elicit in the case of a large flaccid abdomen.

† Gradual downward extension of the disease will, of course, involve the reflexes, and lead to their disappearance in time from above downwards.

‡ Either as to *degree* or *rapidity* of response, *e.g.*, disorders of sensation.

§ *Cf.* functional paralysis, p. 114.

The *deep* reflexes are of great importance, although their mechanism is at present but little understood. Several varieties have been described, but only two need be noticed here, viz., *knee jerk*, or patellar-tendon reflex, and *ankle clonus*. Note that the knee jerk is present in health, † whilst ankle clonus is absent. To produce the knee jerk the patient's leg must hang *loosely*, whilst a sudden tap is given to the ligamentum patellæ by means of the finger tips or otherwise. Practice alone will enable the student to judge of the degree of response; whether normal, exaggerated, diminished or absent, and he must remember that it is seen at its best in children and at its slightest in old people. It is *increased* in (1) exhausting diseases, hysteria, and chronic rheumatism; (2) strychnine poisoning and tetanus; (3) spastic paralysis and multiple sclerosis; (4) the early stage of peripheral neuritis. It is diminished or absent in (1) locomotor ataxia; (2) atrophic paralyses, whether spinal or peripheral, *e.g.*, infantile paralysis, alcoholic paralysis, (3); pseudo-hypertrophic paralysis, &c.‡ Ankle clonus is the term applied to a peculiar contraction of the calf muscles which may be elicited under certain conditions by grasping the foot, the knee being slightly bent, and suddenly flexing it forcibly. The result is a series of clonic contractions of these muscles, generally about five or six contractions in a second. It is present, as a rule, in those diseases where the patellar reflex is exaggerated, and absent where the latter is diminished, its great cause being sclerosis of the lateral columns. Its presence is indicative of disease or at all events loss of cerebral control.

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* One person should stand *behind* the patient and cut off the light with his hand for a minute or so, whilst another person standing in front watches the pupil when the hands are removed. Contraction may also be caused by bringing a bright light suddenly in front of the eye. Each eye should be tested separately.

† But not invariably.

‡ "In descending myolitis it sometimes constitutes a valuable premonitory symptom of approaching bladder disturbance, for if it be noticed that the muscles on the front of the thigh are getting weak and wasted and that the knee jerk is lost, it is highly probable that paralytic incontinence of urine will soon appear."—*Judson Bury.*

ELECTRICAL EXAMINATION OF MUSCLES.

This is a part of the systematic examination of the nervous system which it is extremely difficult to carry out satisfactorily in India, owing to the general want of suitable apparatus in good working order. The subject will, therefore, only be outlined here.* "It is important to recognise at the outset that there is essentially only one kind of electricity. If we develop it by friction between non-conductors, we obtain it in its static form; if by contact between conductors in the presence of chemical action or of heat, in its galvanic form; and if by induction by magnets or by currents, in its faradic form; yet, however obtained, the difference in its character is only one of degree." For purposes of diagnosis the two latter only are used. Most Indian hospitals are supplied with instruments for the production of faradic electricity—either in the form of a cell connected with an induction coil, *i.e.*, an induction machine, or of an electro-magnetic machine. From either of these the so-called *interrupted* current is obtained. Besides this it is necessary to have a galvanic battery, consisting of a large number of small cells, furnishing a so-called *continued* current.† The electro-magnetic machine is of very slight use for purposes of diagnosis, because it contains no dial or indicator of the strength of current used. Similarly a galvanic battery to be of value requires, in addition to conducting cords (rheophores) and electrodes of various kinds, (1) either a dial collector of cells or a rheostat, to alter the strength of the current; (2) a commutator, to reverse and to interrupt the current; (3) a galvanometer, graduated in milliamperes, to indicate the strength of the current.

Practically, it is impossible, except in physiological experiments, to act on the muscles apart from their nerves, but it is common to speak of stimulation of the nerve when the electrode is applied to the nerve trunk directly and of stimulation of the muscle when the electrode is applied on the muscle directly.*

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* There are very numerous special articles and works on this subject: see the various large works on clinical and systematic medicine. *Practical Medical Electricity*, by Dawson Turner, M.D., is recommended for perusal.

† A 'continued' current is one that 'flows steadily in one direction without interruption' as, *e.g.*, from galvanic cells or accumulators. An 'interrupted' current 'flows,' also, 'in one direction, but intermittently' as, *e.g.*, the primary current of an induction coil. A third form is the 'alternating' current, which is constantly changing its direction, the two poles becoming negative and positive in turn, as, *e.g.*, that derived from the secondary coil of an induction machine.

Presuming, then, that we have the necessary apparatus in working order, the method of examination would be as follows: The patient is placed in a good light: both electrodes and the skin over the surface to be examined are moistened with a solution of salt in warm water: one large electrode is placed over the upper part of the sternum and fixed there: the other electrode is held in the examiner's hand and placed (*a*) over the motor nerve trunk, (*b*) over the individual muscles in turn. In the former case all the muscles supplied by the nerve will contract.

It is best to begin with the faradic current, using a weak one at the start so as to ascertain the minimal current required to produce contraction. If there is a difficulty in obtaining a reaction, moisten the skin thoroughly and use a strong current, reverting to the weak one afterwards. With the galvanic battery, a few cells should be put in circuit and the negative electrode placed over the nerve or muscle, the current being gradually increased in strength till a re-action is obtained on closure (K.S.C.).† Each time the current is strengthened the closure should be made thrice with the commutator. Now reverse the current by means of the commutator, so that the positive electrode becomes the exciting one, and note the minimal current required to produce contraction on closure (A.S.C.). Then note in turn the effect on opening with a weak, medium, and strong current, first with the positive pole (A.O.C.) and then with negative pole (K.O.C.). Considerable practice is necessary in order to obtain accurate results and even then the 'personal factor' in the shape of the examiner is a source of inexactness. The same methods must be rigidly observed and homonymous parts examined together, *e.g.*, the right median nerve, then the left median nerve, and so on, or, when the disease is unilateral, the nerve or muscle of the sound side first.

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* Or to the so-called 'motor point' or spot at which the special branch from the nerve trunk enters the muscle. In health the same effect is produced whether the electrode is applied to the body of the muscle or to the motor point, but not in certain diseased conditions.

† K. = Kathode, A. = Anode, S. = Closure of current, O. = Opening of current, C. = Weak contraction, C′. = Moderate contraction, C.″ = Strong contraction, Ct. = Tetanic contraction.

ELECTRICAL RE-ACTION IN HEALTH.

The law of *normal contraction with galvanic stimulation* is as follows:—

Weak currents give K.S.C.,
Medium currents give K.S.C.″, A.S.C., A.O.C.,
Strong currents give K.S.Ct., A.S.C′., A.O.C′., K.O.C.

That is, *weak* currents give slight contraction on closure at the kathode, none at the anode—*medium* currents give slight contraction at the anode both on opening and closing, strong contraction at the kathode on closure—*strong* currents give slight contraction at the kathode on opening, strong on closing, moderate contraction at the anode both on opening and closing.*

The law of *normal contraction with faradic stimulation* is simply that the degree of contraction produced varies directly as the strength of the current applied.†

Electrical re-action in disease.—It is found that the changes in electrical re-action which result from disease are both *quantitative* and *qualitative*.

In simple quantitative change there may be increase or decrease, more generally the latter. In unilateral disease, information is obtained by comparing two sides of the body together, and in bilateral disease, by comparing different parts of the body which are known to react to currents of about the same strength. Great care is necessary in making such determinations, and very slight differences should be disregarded. If, however, a quantitative change is detected with certainty it indicates disease of some portion of the motor path and, hence, is of value in distinguishing organic from functional disease. *Increase* of excitability is seen in tetany * and sometimes in peripheral neuritis (temporarily), locomotor ataxy and hemiplegia. *Diminution* of excitability is seen in cases of cerebral and spinal paralysis in which there is muscular atrophy, *e.g.*, multiple sclerosis, progressive muscular atrophy, myelitis, pseudo-hypertrophic paralysis, and in the muscular atrophy associated with disease of muscles (from joint fixation, &c.,) and chorea. In extreme cases where no contraction results from the strongest current of the galvanic battery the muscle must have been totally destroyed.†

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* Note that *in health* K.S.C. exceeds A.S.C. with currents of all strength.

† Contraction results whether the electrode is applied to the nerve or directly to the muscle, but in the latter case the contraction is not so extensive. The student will remember that, in physiological experiment, it can be demonstrated that the interrupted current has no action on muscle fibres apart from the nerves, *i.e.*, there is no true farado-muscular irritability: the constant current, on the other hand, can act on a curarised muscle, the sequence of the polar contraction remaining the same, but the contractions are altered in *character*, being delayed and prolonged instead of sudden and short.

The chief qualitative change in electrical reaction, with which is associated quantitative change as well, is termed the *reaction of degeneration.* Two forms of this are described, (*a*) the 'partial' R.D., and (*b*) the 'complete' R.D., of which the latter is the more typical and important. Complete R.D. is thus characterised.‡

1. As the nerve undergoes degeneration its faradic and galvanic excitability diminishes and at the end of about fourteen days is entirely lost.

2. The faradic current applied to the muscle causes no contraction, the intra-muscular nerves having degenerated and there being no idio-muscular faradic irritability.

3. During the first ten days from the onset of the disease, or from the time of injury, the galvanic irritability of the muscles is diminished; then it is increased to slowly interrupted currents, and the following serial qualitative changes are observed :—The sequence of the polar reactions is altered,

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* Mere percussion or compression is sometimes sufficient to cause muscular contraction in this disease. Gowers states that it is the only disease in which A.O.Ct. has been observed.

† Increased response to the galvanic current with 'reaction of degeneration' means degeneration of the muscle (not complete): diminution or loss of faradic irritability, in a nerve, points to its degeneration in a muscle, to degeneration of its nerve only (*vide* foot-note, preceding page).

‡ Suckling, altered. Diagrams illustrating this reaction (after Erb) will be found in Graham Brown, *op. cit.*, and other text-books.

the anode taking the place of the cathode, and the order of the contractions with currents of increasing intensity is—

1. A.S.C. 2. K.S.C. 3. K.O.C. 4. A.O.C.	in place of	1. K.S.C. 2. A.S.C. 3. A.O.C. 4. K.O.C.

4. The following changes in the mode of contraction are also observed. Instead of being short, sharp and sudden, they are slow, prolonged and apt to become tetanic, and are produced only by slow interruptions of the current.

In partial R.D. the essential difference is that the muscles continue to act to faradism, but all stages have been observed in different cases between partial and complete R.D., and it may be very difficult to ascertain whether degenerative atrophy has begun or not.*

As to the application of the above considerations to questions of diagnosis, the following outline must suffice. If the lesion is above the nucleus of a motor nerve, there is no R.D. and at most but slight quantitative change. If, therefore, R.D. is present in the area of distribution of a cranial nerve, the disease must involve either the nucleus or the trunk of the nerve. It also follows that in ordinary cerebral paralyses R.D. is absent. When, however, the lesion involves the nucleus of a nerve or its trunk both quantitative and qualitative R.D. changes are found. R.D. is, therefore, specially characteristic of diseases involving the anterior cornua of the spinal cord,† the nuclei of the medulla or the peripheral nerves, *i.e.*, in diseases affecting the *lower* segment of the motor tract, such as infantile paralysis, diffuse myelitis, bulbar paralysis, amyotrophic lateral sclerosis, and in alcoholic, rheumatic, diphtheritic and other forms of peripheral neuritis.‡ The student must remember, however, (1) "that there is no necessary relation between paralysis and the reaction of degeneration; and (2) that no direct information as to the *nature* of the lesion—whether inflammatory, toxic, or traumatic—is afforded by an electrical exploration of nerves and muscles."*

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* "Very often the patient is not examined until the increased excitability of the muscles to galvanism has disappeared, but if the movement on contraction is '*distinctly slower and less lively* than in health, the presence of some degree of degenerative atrophy may safely be inferred."—Judson Bury.

† With the exception of *chronic* spinal disease, *e.g.*, progressive muscular atrophy, in which case R.D. is not usually present.

‡ In slight cases quantitative changes only; qualitative changes (R.D.) absent.

In the matter of prognosis this method is also of great value, for the application of the foregoing principles enables us generally to distinguish organic from functional disease,† disease involving the nerve nuclei, anterior cornua, &c., from other forms of paralysis and, in the case of peripheral neuritis, to form an opinion as to whether a case is likely to do well or not.

AFFECTIONS OF CO-ORDINATION AND GAIT.

Whilst in health co-ordination of the muscular movements is so perfect as to be quite unconsciously performed, it is very seriously interfered with in certain diseased conditions. To defective co-ordination the term *ataxia* is generally applied. Anything which interferes seriously with the muscular sense or the various reflexes, or with the sensory or motor tracts, is apt to cause defects in the complex muscular adjustments essential for proper standing or walking, &c. It is highly probable that there are special co-ordination centres situated in the basal ganglia and cerebellum, and it is well known that disease of the middle cerebellar lobe is specially prone to cause disturbance in the balancing power.

The most typical example of ataxic gait is seen in locomotor ataxy in which it results from disease of the posterior columns of the cord. The foot is raised unnecessarily high at each step and brought down with a sudden stamp on the heel. The centre of gravity for the body is changed constantly during progression and, when the disease is advanced, the patient may be quite unable to walk without assistance owing to a tendency to fall forward. The gait in disseminated sclerosis is somewhat similar. In other forms of nervous disease the gait is often more or less characteristic, *e.g.*, the dragging action of the leg in spastic paraplegia, the waddling in pseudo-hypertrophic paralysis, the mincing gait in peripheral neuritis, typically seen in beri-beri, &c.

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* Judson Bury.

† *Vide* p. 114. If qualitative changes are found there must be organic disease; but organic disease *may* exist without qualitative changes being present.

The important point to ascertain first of all is the presence or absence of ataxia, and this is done by making the patient perform various movements and noting whether they are done in a normal fashion. He should also be made to walk along a straight line, to stand with his eyes shut and his feet close together, but not touching, and to walk backwards. A patient with advanced locomotor ataxy is quite unable to do any of these actions. Ataxia may occur in cerebellar disease, hysteria, peripheral neuritis, multiple sclerosis and syphilitic disease. The differential diagnosis cannot be discussed here.*

The various forms of *vertigo* or giddiness fall to be mentioned here, but space forbids any detailed notice. This symptom may be due to a variety of causes quite independent of organic brain disease and before vertigo can be ascribed to this latter source we must exclude gastric disorders, affections of the ocular apparatus or of the outer and middle ear, anæmia, &c. What is known as 'labyrinthine vertigo' occurs as a symptom of Menière's disease, receiving its name from the fact that the semi-circular canals, which are intimately concerned in equilibration, are involved. Vertigo is a common symptom in cerebellar disease, especially when the middle peduncle is involved, and in disease of the crura cerebri, corpora quadrigemina, and pons Varolii.

VASO-MOTOR FUNCTIONS.

That various causes may exalt or depress the governing centres of the vaso-motor apparatus and thereby induce important changes of a general or local character, is well known, but the facts and observations are as yet too vague and too dimly comprehended as to their significance to be of much use for diagnostic purposes. Increased paleness or redness of the skin, and a corresponding fall or rise in the local temperature, have been noticed in a good many nervous conditions, such as migraine, hysteria, epilepsy, &c., and in other diseases, such as ergotism, diabetes, &c. In this country it is very general to find amongst Europeans a 'relaxed' condition of the cutaneous arterioles in which, when the skin is stroked with the finger or a pencil, a streak of redness appears and remains for a long time. To this condition, which is sometimes seen spontaneously in epilepsy and other nervous diseases, Trousseau gave the name of *tâche cerebrale.*[*]

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* *Vide* Suckling, *op. cit.*, page 222.

NUTRITIVE (TROPHIC) FUNCTIONS.

That the metabolism of the various tissues is governed or regulated by the nervous system may be taken as proved. This *trophic* influence, as it is called, may be diminished or completely abolished by any condition affecting the nerves supplying the part, the result being a very serious interference with the nutrition of certain portions of the bodily structure. A careful outlook for such lesions must always be kept in nervous cases. The skin is specially liable to be affected. It is probable that the nerves concerned leave the spinal cord by the posterior nerve roots.[†] Pigmentation, bleaching, bronzing and various erruptions of the skin, typically *herpes zoster*, [‡] may be thus caused. *Glossy skin* is a condition that may follow severe injury of the peripheral nerves, the skin being shiny, often hairless, and the creases obliterated in correspondence with the area of distribution of the nerve. *Acute decubitus* is the name given to a form of bedsore occurring in nervous disease and differing from the ordinary bedsore, due to pressure, in the extraordinary rapidity with which it may appear, its incurability by local treatment and its situation. When due to cerebral disease it is generally situated in the centre of the gluteal region on the paralysed side : when due to spinal disease it forms nearer the middle line in the sacral region; but in unilateral spinal disease it occurs on the anæsthetic and not on the paralysed side.[§] The perspiration, nails, hair, in fact, all the cutaneous structures or secretions, may be involved in different cases. Several highly interesting forms of ulceration or gangrene may occur, such as the 'perforating ulcer' of the foot in locomotor ataxy, Raynaud's disease, leprosy, &c. So, also, trophic disorders of the bones and joints,[||] muscles, viscera, &c., are seen, but cannot be further noticed here. A true tropho-neurotic wasting of muscles occurs in disease of the anterior cornua of the cord or of the peripheral nerve fibres proceeding from thence, and in such cases the 'reaction of degeneration' is found to be present.

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[*] It is often well seen on the hypothenar eminence of the hand in debilitated Europeans in India.

[†] It is considered by some that the nerves concerned arise from the cells of the posterior cornua.

[‡] Some doubt has been cast recently on the nervous origin of this disease.

[§] A point which may indicate that the trophic nerves, like the sensory, decussate in the cord—Ross.

[||] The 'brittleness' and consequent liability to fracture of the bones in locomotor and in insane persons should be specially remembered as a practical point in regard to the handling of such persons.

CEREBRAL AND MENTAL FUNCTIONS.

Examination may show that the intelligence of the patient is impaired and the examiner must do his best to ascertain whether such impairment is due to purely temporary causes, such as fever, the action of poisonous substances circulating in the blood, &c., or whether it is the result of injury to or of organic disease of the brain.

Practically, all conditions of complete unconsciousness are included under the term *coma*—a state which may be due to poisoning (opium, alcohol, chloroform, &c.) with chemical substances from without, or to auto-intoxication (uræmia, diabetes); to cardiac syncope, cerebral disease, epilepsy, sunstroke, &c. The differential diagnosis between apoplexy, narcotic and alcoholic poisoning is sometimes very difficult, but the student will rarely be called upon to make such diagnosis.

The name *coma vigil* is given to the condition where a patient, completely unconscious, lies on the bed with his eyes wide open. It is seen in cerebral disease.

As regards sleep, a patient may suffer from *insomnia* or want of sleep, from *somnolence* or excessive sleepiness, or even from *somnambulism* or sleep-walking. Insomnia is a very frequent and troublesome symptom in disease, and its presence or absence must be carefully inquired into.

The disorders of speech are of great interest and importance, but the subject is very complicated and by no means thoroughly understood. In any case where speech is from any reason obviously defective, the student or other observer would do well to look up the subject in some work on nervous diseases. Only a few of the more prominent points can be alluded to here.

In the use of language an 'out-going' and 'in-going' mechanism is involved. The former is made up of cortical centres connected by nerve fibres with centres in the medulla and spinal cord from which pass nerves for the supply of the muscles used in articulation, writing, &c. Under the in-going mechanism are included the eye and ear * with the sensory paths therefrom to their centres. It is thus possible to divide disorders of language into motor and sensory, as with other paralyses.

Passing over the various defects of articulation, such as *stammering*, which are due, for the most part, to disease of the muscles, their nerves or nuclei of origin, the student must note the term *aphasia*. Under this name are included the disorders of speech due to *cerebral* disease, and which resu ltfrom (1) paralysis of the special movements of articulation or of the hand in writing, or (2) paralysis of the receptive sensory centres. To (1) the name *motor* aphasia is given, to (2) the name *sensory*. Very frequently the two are mingled, however, constituting *total* aphasia.† It must, however, be carefully noted that aphasia is *not due to a paralysis of the muscles of articulation and phonation,* but to a 'mental inability to select the proper word or to determine the necessary movements for its pronunciation, *i.e.*, it is the higher or governing cortical centres which are at fault and cause the various forms of speech disorder. In motor aphasia there is no paralysis of the muscles used in speech and the patient has perfect 'word-recollection,' *i.e.*, he hears quite well and knows what he wants to say but cannot say it, or only in a very imperfect manner. He may be unable to write (*agraphia*) or to read (*alexia*), although the muscles involved in either act are not paralysed. Of sensory aphasia there are also various degrees. It is sometimes called 'word-deafness.' The patient hears the words spoken but does not understand their meaning. He may have great difficulty in recalling words, *i.e.*, 'word-recollection' is defective; in well-marked cases he may be quite unable even to repeat heard words, using a wrong word instead or mixing up the syllables. In every case of suspected aphasia the following tests should be made :—

(1) Ability to recognise the nature and use of objects.
(2) Ability to recall the names of things seen, smelled, touched, heard.
(3) Ability to understand spoken words.

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* And sense of touch in the blind.

† The speech centres appear to be situated in the left third frontal and first temporal convolutions: in left-handed persons the centres are often on the right side of the brain. The *motor* centre is in the frontal convolution, the *sensory* in the temporal region: it is obvious that the relative preponderance of either form of aphasia will help towards elucidating the site of lesion. (*Vide* also Chapter IX.)

(4) Ability to understand printed or written words (and musical tunes, if possible).

(5) Ability to read aloud and to understand what he reads.

(6) Ability to write and to understand what he has written, to copy writing, to write from dictation.

(7) Ability to repeat words heard.

By careful inquiry into these points the student may do a great deal to help towards a diagnosis in any case of aphasia. In practice, such diagnosis is often extremely difficult.

CHAPTER XI.

THE BODY TEMPERATURE IN HEALTH AND DISEASE.

Clinical thermometer.—There are several varieties of this instrument in use for special purposes but only one will be noticed here, the ordinary cylindrical, mercurial, maximum, clinical thermometer. Even this form varies a good deal as to details of construction. The most satisfactory is that which indicates the maximum temperature in about five minutes or a little less, and which magnifies the scale against an opaque ground.* Every thermometer for clinical use should be self-registering (so-called), *i.e.*, the index should remain at the highest point reached until purposely shaken down.

Taking the temperature.—The temperature may be taken on the body surface,† in the mouth, axilla, groin ‡ rectum or vagina. By far the most usual place is the axilla. Before inserting the instrument, the index must be shaken down to 95° F. with one or two jerks, the hand being held at right angles to the forearm. The axilla must be carefully dried, the thermometer carefully inserted in it, so that the bulb does not project behind, and the patient's arm laid gently across his chest. When the mouth is selected the instrument is placed under the tongue and kept in position by the patient's lips. He should not have taken any very hot or cold drink for some time previously. When the rectal temperature is desired it is necessary (*a*) to ascertain whether the rectum is free from fæcal accumulation, (*b*) to oil the instrument. In every case the thermometer must be *thoroughly cleansed after use*—a sanitary detail constantly neglected by nurses and students.

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* The best thermometers are sold with a 'Kew' or other certificate denoting the amount of constant error. In any case the instrument should be tested before or after purchase with a reliable thermometer under similar conditions. At intervals of a year or two a thermometer should be re-tested, as the amount of error alters with lapse of time, generally in a + direction.

† Special instrument required.

‡ A very good place in the case of infants and young children.

Recording the temperature.—This is done by means of a temperature *chart* constructed upon the same principle as all charts for illustrating changes graphically by curves. A well-designed chart, kept accurately, shows the height of the temperature and the time of observation by means of a single dot. In ordinary cases the temperature should be recorded twice every twenty-four hours and always at the same time, say 6 a.m. and 6 p.m.; but it is very often necessary to take it more frequently. In serious cases of typhoid fever, acute pneumonia, &c., a 4-hour chart is most useful and instructive. In intermittent fever the temperature should be taken once or twice during the paroxysm, as well as morning and evening.

The body temperature in health.—The normal temperature is about 98·6° F. in the axilla, but it is subject to a daily fluctuation entirely independent of external circumstances, *rising continuously from morning till evening and sinking again from evening till morning.* It is at its lowest, 97·5° to 98·0° F., at two hours after midnight, remaining about the same point till early morning. It then rises slowly and constantly till four or six in the afternoon, when it is at its highest, 99·0° F. to 99·0° F. (99·9° F. in Bengal, Crombie). This temperature is maintained for a short time, when it again sinks, at first slowly, afterwards more quickly, to the morning minimum. The difference between the morning minimum and the evening maximum is about 1·3° F.

Crombie's observations lead him to believe that the mean temperature of Europeans in Lower Bengal is 0·5° F. higher than in England. He also says that the temperature of natives of India, including East Indians, is higher than that of Europeans resident in India by about 0·5° F.

Dr. Ringer states that in persons under twenty-five, the average maximum temperature is 99·1° F., in those over forty, 98·8° F. The normal temperature is *raised* by active exercise,* and temporarily by taking food or by a very warm bath; it is *diminished* by exposure to cold without active exercise, by severe mental exertion, and by cold bathing.

The guide for the clinical observer to follow is thus stated by Aitkin. *A rise above 99·5° F. [99·9° F. in India], or a depression below 97·3° F., is a sure sign of some kind of disease if the change is persistent.*

The temperature in the mouth is generally about 0·5° F. higher, and in the rectum about 0·9° F. higher, than in the axilla. During sickness these ratios may be very much altered, and it is by no means rare to find the temperature in the rectum several degrees higher than in the axilla. Hence, when the temperature is taken anywhere save in the arm-pit, it should be clearly stated where the thermometer was placed.

The body temperature in disease.†—Any elevation of the temperature above the normal limits, exclusive of the special causes mentioned above, constitutes a condition of 'fever.' It must not be forgotten, however, that a patient in a very dangerous state may still have a normal temperature. The degree of 'pyrexia' or fever has been thus classified:—

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* Especially if the exercise is taken 'in the sun' in India.

† "The stability of the temperature in the healthy body is due to the central regulating apparatus called the thermotaxic mechanism, which controls the production and the dissipation of heat. Fever is a condition characterised by an increase of temperature with, usually, increased disintegration of nitrogenous tissue. The muscles and large glands, as is well known, are the chief seats of heat production. Both heat production and heat dissipation are believed to be under the control of the nervous system, either through the motor nerves or special nerves which pass with them to and from definite centres in the brain called heat centres. In conditions of disease this thermotaxic mechanism may be altered, so that the normal temperature is increased or lessened: (1) there may be elevation of temperature from diminished dissipation of heat, though not necessarily increased nitrogenous disintegration and disordered function; or (2) there may be increased production of heat with diminished dissipation, hence temperature will naturally be higher than if the increased heat production were accompanied by normal heat dissipation; (3) there may be increased heat production and at the same time increased heat dissipation, in which case there would be the increased waste of fever with or without any elevation of temperature; (4) it is possible that heat dissipation may be greater than heat production, or that the thermotaxic mechanism may be disturbed so as to promote loss, in which case there will be sub-normal temperature."—*Musser.*

Temperature Range.	State.
Below 96°	Collapse temperature.
96° to 97·5°	Sub-normal temperature.
97·5° to 99·5° (99·9°)	Normal temperature.
99·5° (99·9°) to 101°	Slight fever.
101 to 103°	Moderate fever.
103° to 105°	High fever.
Above 105°	Hyperpyrexia.

There is no constant ratio, however, between the height of the temperature and the danger to the patient. For example, in intermittent fever the temperature may rise rapidly to 105° or 106° without any appreciable ill-effects, whereas in other diseases, *e.g.*, rheumatic fever, such a rise would have a serious import. It is much more the *duration* of a fever which is important, and hence the good effects which follow a system of treatment that results in a moderate average temperature during a continued fever.*

Just as in health there is a daily fluctuation, so in fever; only in the latter case the difference between the morning remission and evening exacerbation is usually considerable. In some diseases, especially tuberculosis, there may be morning exacerbation and evening remission; in other cases there is no regularity as to time between the rise and fall.

Course of fever.—The febrile period is divisible into three stages, viz.: (1) onset, invasion or initial stage; (2) acme, *fastigium*, or highest stage; (3) decline or stage of defervescence. During the onset or 'pyrogenetic' stage, the temperature begins to rise and continues to do so till the second stage is reached, but the rate of rise varies very much in different diseases. Where it is very rapid, as in pronounced intermittent malarial fever, it may be ushered in or accompanied by a rigor or severe shivering.† In some diseases, *e.g.*, croupous pneumonia, this stage may last a day or two; in others, *e.g.*, enteric fever, the maximum temperature is only reached after several days of imperfect remissions. The second stage or *fastigium* should be considered according to "its height, its character, the extent of its daily variations and its duration," but space forbids further discussion of the subject here. The student must study the different types of fever as seen in clinical work and note how in some diseases, *e.g.*, intermittent fever, this stage is of very short duration, whilst in others the pyrexia may continue for weeks or even months, *e.g.*, tuberculosis, syphilis, remittent malarial fever, rheumatism, chronic suppuration, &c. In most of the acute specific diseases, such as croupous pneumonia, small-pox, measles, erysipelas, &c., the fastigium lasts from four to six days, whether the invasion and decline are gradual or sudden. In a favourable case the third stage—defervescence—is characterised by a sudden fall of the temperature, *crisis*, or by a gradual, but steady, lessening of the fever, *lysis*. A typical case of croupous pneumonia shows the former, of typhoid, the latter type. Between true crisis and lysis there are all varieties of defervescence. Sometimes during lysis the temperature drops suddenly to normal or nearly so, and then rises again to continue falling by degrees as before. This has been named *pseudo-crisis*. Very frequently, during the third stage of a fever, or even after the temperature has been normal for some time, a sudden rise takes place, which may last for a varying period. The term *relapse* is applied to this, and the cause is generally over-exertion, chill or error in diet.* When a case is tending towards an unfavourable issue there may be no third stage proper; instead, the temperature suddenly shoots up to marked hyperpyrexia, or drops to below normal, or exhibits great irregularity. Sudden hyperpyrexia is common in rheumatic fever, sunstroke, cerebral hæmorrhage (into pons or medulla), or severe burn, and is sometimes seen in enteric fever. Collapse temperatures are common in certain forms of acute tuberculosis, intestinal hæmorrhage or perforation, cardiac failure in pneumonia, cholera, septic and ptomaine-poisoning, &c.

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* The evil effects commonly attributed to prolonged high temperature have lately been denied, apparently on grounds quite insufficient to negative the accepted ideas on the subject.

† Although the patient feels very cold during this stage and covers himself with blankets, the actual temperature may be far above the normal; and this feeling of chilliness lasts in some cases till the temperature begins to fall.

Types of fever.—There are several leading types with which the student must be familiar, since every case of fever is supposed to belong to one of these. As a matter of fact, just as the different febrile stages may vary, so the student will meet with many cases of fever which cannot honestly be included under any one type. Still it is "certain that the recognition of a particular type forms a positive aid to diagnosis." The four leading types are (1) the *continued*, (2) the *remittent*,

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* *Vide post*, p. 134.

(3) the *intermittent*, (4) the *relapsing*. A continued fever is one that lasts for more than two days in which the difference between the daily maximum and minimum is less than 2° F. A remittent fever is a fever lasting more than two days, in which the daily difference is greater than 2° F. In an intermittent fever there is a rise of temperature followed by a fall to or below the normal, occurring at least once during the twenty-four hours. When the paroxysms occur daily, *i.e.*, about twenty-four hours' interval, the fever is called *quotidian* intermittent; when they occur every third day, *i.e.*, about forty-eight hours' interval, it is called *tertian* intermittent; when they occur every fourth day, *i.e.*, about seventy-two hours' interval, it is called *quartan* intermittent, and so on. In the relapsing or recurrent type, which is almost confined to one particular disease, relapsing or famine fever, there is a period of high continued fever followed by a crisis, in which the temperature drops to the normal point or below it, remains thus for several days and then rises again as at first and falls again. This may occur several times before the disease abates, but each time the fever is less and of shorter duration. These various types are shown in the illustrations given. The student should avoid associating a particular type of fever only with a special disease, save perhaps as regards the last-named. It is true that the intermittent type is specially characteristic of a certain form of malarial disease but it is by no means confined to this disease, being seen in some cases of tuberculosis, chronic syphilis, &c. He should also remember that the ordinary chart on which the temperature is recorded only twice in the twenty-four hours may fail to bring out the true course of the fever; indeed, any chart must be considered defective which does not record the highest and lowest temperatures during each day.

Local elevation or lowering of the temperature.—Either of these phenomena may sometimes be observed. The former occurs specially in some cases of hysteria and of recent paralysis, the affected side showing a higher temperature than the other. Local lowering of the temperature is seen where there is general defectiveness of the circulation (cardiac failure), the nose, ears and other exposed parts becoming cool, and also where there is localised interference with the circulation as in œdema, thrombosis, embolism, &c.

Diagnostic value of changes of temperature.—In using the temperature curve as an aid to diagnosis in disease it is necessary to remember that many factors, some of which are likely to be overlooked or even remain undiscoverable, combine to alter or interfere with the curve. In India this seems to be especially the case, and more so as regards the poorer class of natives such as one meets with in hospital practice. A "pyrexial temperature is more unstable than a normal one" to begin with; then there is the fact that nearly all the patients are under-fed and weakly when admitted; lastly, there remains the important point that malarial disease in one form or another is nearly universal. It is rather the fashion at the present time to ignore the latter factor or even to deny its existence. Careful observation, however, should convince the student of its great importance. A chill, an error in diet, a sleepless night, indeed almost any irritating or depressing agent, will suffice to bring on 'fever' in such a subject, with consequent effect on the temperature curve.* Many a simple case of asthma or bronchitis in India shows a fever chart which would create the greatest alarm if seen in an English ward. Whilst, then, 'fever' is distinctly commoner in an Indian than an English ward, the duty of the student is to accustom himself to distinguish, so far as he can, between that fever which is accidental or supplemental and that which is essential to different diseases. If he is careful to do this, he will afterwards find himself distinctly more successful in his treatment of cases of fever than do those who are careless or sceptical in regard to this matter.

Concluding points.—The observer must always recognise the possibility of *malingering* by certain patients. There are various ways by which the temperature record or the thermometer itself may be tampered with. Where there is any doubt, the temperature should be taken in the usual way and then, some simple excuse being made, the observer should take the temperature *himself*, at once, in the mouth or axilla, or in both places. In the former case the mouth should be previously inspected; in the latter both hands of the patient must be kept above the bed clothes the whole time, the axilla being first of all carefully examined under pretence of drying it.† Sometimes it is inadvisable to mark the true temperature on the bed-head chart when the patient is of a

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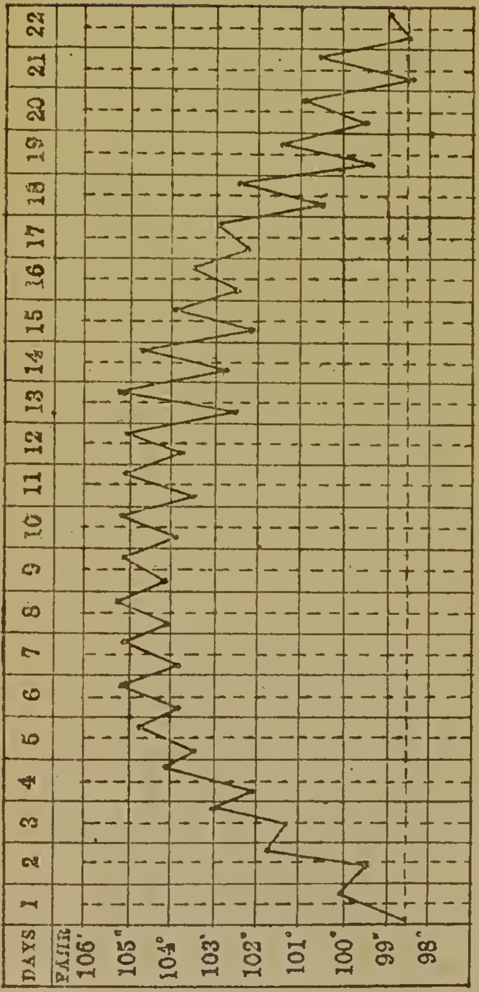
* No suggestion is here made or intended as to the existence of hybrid diseases, such as typho-malaria so called.

† I have known a patient pass his free hand round behind his back and rub the thermometer bulb, and another patient keep a small bottle full of warm water secreted near the axilla.

PLATE VI

TEMPERATURE CHARTS



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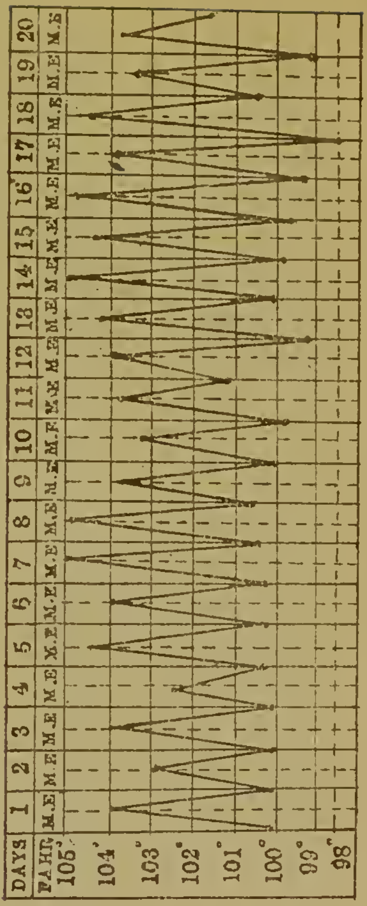

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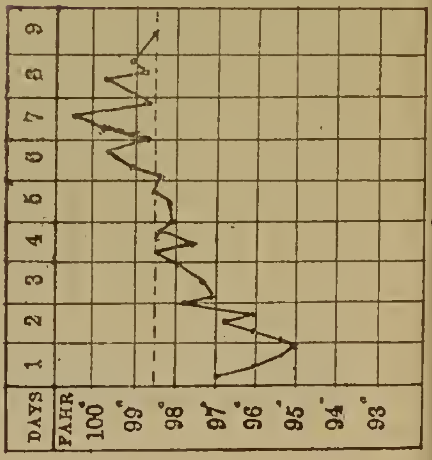


PLATE VI.—TEMPERATURE CURVES OF DISEASES.

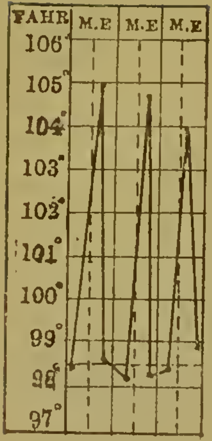
Fig. 1. (After Wunderlich.) TEMPERATURE CHART OF ENTERIC FEVER Typical case; continued fever gradually rising to the acme and terminating by lysis; no relapse. Such a temperature curve for enteric fever cases is the exception and not the rule in India. Usually the temperature shows much larger remissions and greater irregularity.

Fig. 2. TEMPERATURE CHART OF ASIATIC CHOLERA: Mild case with very slight secondary fever.

Fig. 3. (After Finlayson.) TEMPERATURE CHART OF 'HECTIC' FEVER (TUBERCULAR): Temperature taken in the rectum six times in 24 hours, and only maximum and minimum shown.

PLATE VII

TEMPERATURE CHARTS



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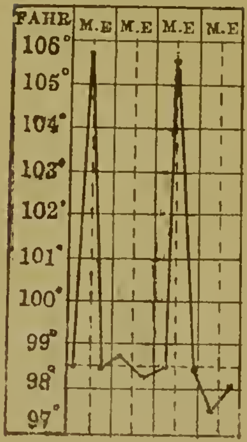

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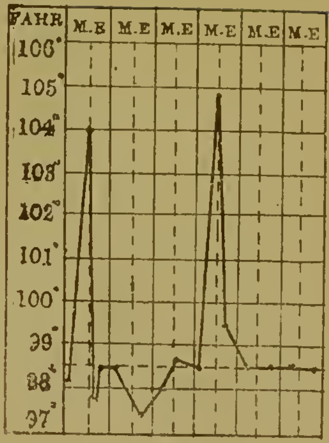

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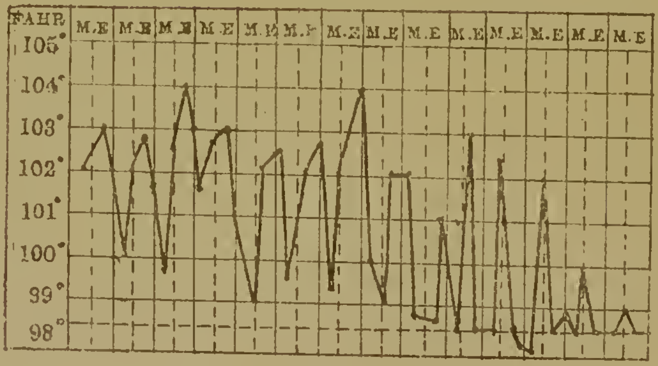

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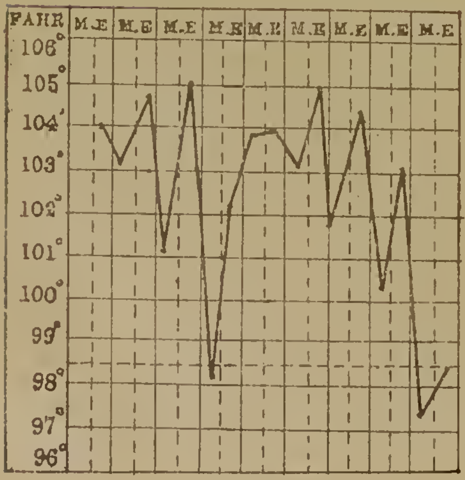

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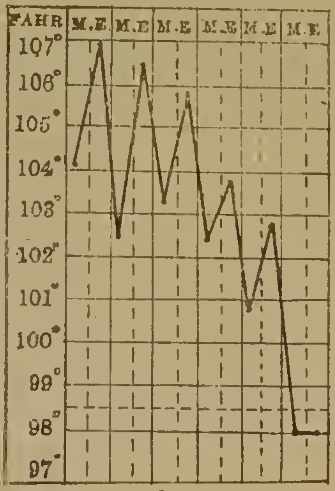

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PLATE VII.—TEMPERATURE CURVES OF DISEASES—*continued.*

Fig. 1. Temperature Chart of Quotidian Intermittent Fever: Interval between paroxysms = 24 hours (approximately).

Fig. 2. Temperature Chart of Tertian Intermittent Fever: Interval between paroxysms = 48 hours (approximately).

Fig. 3. Temperature Chart of Quartan Intermittent Fever: Interval between paroxysms = 72 hours (approximately).

Fig. 4. Temperature Chart of Remittent Malarial Fever: Mild case in which the temperature gradually assumed an intermittent character.

Fig. 5. (After Wunderlich.) Temperature Chart of Lobar Pneumonia: Typical, mild case: crisis on the 8th day; pseudo-crisis on the 4th day.

Fig. 6. (After Wunderlich.) Temperature Chart of Broncho-Pneumonia: Gradual fall, or termination by lysis.

very nervous temperament. In such a case a true chart must be carefully kept by the student in his case record.

While it is important for the student to accustom himself to the 'feel' of the skin, as to the presence or absence of fever, it must be remembered that the thermometer is far and away more accurate and substitutes a 'fact' for an 'impression.' Indeed, it is just in those very cases where the skin feels deceptively cold or hot that the thermometer renders most signal service and prevents serious errors in treatment.

CHAPTER XII.

CLINICAL EXAMINATION OF SKIN DISEASES.

In considering the diagnosis of skin diseases the student will find it useful to refer to the classification of Tilbury Fox in section IV; but to do so with advantage he should make himself thoroughly acquainted with the elementary lesions in section II in order to clearly understand the terms used in reference to skin diseases; at the same time he should bear in mind their probable causation—*vide* etiology, section III.

The student should remember that the disease may be complicated, or that one or more of the groups may be represented on the same patient. The eruptions of the acute specific diseases are always accompanied by the characteristic symptoms of the particular disease. The lesions seen in the different diathetic states (section IV, group 2) are often very mixed; the previous history of the case and the presence of the general symptoms, and signs, characteristic of the particular states, will settle the question.

The student should also remember that the parasitic diseases (section IV, group 9) flourish in the skins of people suffering from the debilitating influences of such diseases as scrofula, syphilis, leprosy and malarial cachexia, and also, that skin diseases of any kind rarely show themselves in healthy people.

The recognition of diseases of the skin amongst the darker skined races of India is considerably more difficult than amongst the fairer, or amongst Europeans. Their customs regarding washing, &c., the underfeeding in some parts of the country, the prevalence of constitutional syphilis, the effects of exposure to malarial influences, the overcrowding in the towns, and the consequent difficulty of obtaining sufficient water for ablution, form the principal causes of diseases of the skin amongst natives. In examining skin diseases the use of a small pocket lens often facilitates the observation.

SECTION I.—RULES FOR OBSERVING.

1. On first seeing a patient, the sex, apparent age, general conformation, complexion and aspect are noted.

2. The patient should always be placed in a good light, and the whole eruption, if possible, should be seen, as quite an erroneous idea may be conveyed by only a partial inspection. To obtain this, the patient should be stripped, if possible; in this climate there is little danger of the patient receiving a chill in this way, but great care should be observed that due regard is paid to the feelings of susceptible patients.

3. There are certain questions which should then be asked in order to clear the ground of several points, viz.:—

(1) what is its **duration.**
(2) what has been its **course.**
(3) what have been the **attendant symptoms** (itching, fever, &c.).

The first if over two or three weeks excludes at once all the exanthemata. The second gives the clue to a large number of eruptions which develop in a characteristic way and differ considerably at various stages of their progress, *e.g.*, erythema multiforme, many cases of eczema, urticaria papulosa, &c. Scratching, poulticing, or previous treatment also modify eruptions. The third question may inform us of symptoms that always accompany certain skin diseases, *e.g.*, itching in scabies and eczema.

4. Take a general view of the eruption as a whole irrespective of the particular elementary lesions present (vesicular, papular, &c.), for the latter taken singly do not constitute the skin disease. The parts of the body affected, the tissues involved, the form, arrangement and grouping of the eruption are of equal and sometimes of greater importance. Thus it may be general as in many cases of eczema and psoriasis, and many erythematous eruptions, while in a large number of eruptions it is more or less limited to one region or part. It may be symmetrical as secondary syphilides (as a rule) or

non-symmetrical as, tertiary syphilides, or in groups in the course of a nerve as, herpes zoster, irregular and scattered as scabies and parasitic eruptions generally, in circles or segments of circles as tinea circinata, &c., or in patches round, oval or irregular, as psoriasis and many others. It may be uniform in character as measles, or multiform as syphilis and eczema. The student should not forget that the variety of eruptions in secondary syphilis is as great as the number of elementary lesion to which the skin is liable.

SECTION II.—ELEMENTARY LESIONS.

It is necessary to describe in brief terms the elementary lesions, or the types of form and aspect presented by these eruptions, and, as the student is required to know these, this description of them may be taken as a general outline of the pathology of the skin.

The elementary lesion are divided into **primary** and **secondary.**

Primary Lesions.

Hyperæmia or **Congestion** may be active (arterial) or passive (venous). Active, *i.e.*, arterial hyperæmia varies in colour from brilliant scarlet to rose pink, is removable by pressure and combined with tingling or other sensations. It may be punctiform or patchy; it is often accompanied by swelling from effusion as in erythema papulatum: by disordered sensation, *e.g.*, pruritus; by slight rise in temperature; and is often followed by desquamation, and occasionally exudation.

Maculæ—Synonyms, spots, stains or macules—are discolorations, level with the skin of various sizes, shapes and tints; though varying they are usually round in shape; but their most striking and variable feature is their colour which is generally some shade of red, yellow or brown. They are due to (*a*) hyperæmia arterial or venous. If arterial the maculæ are red, if venous, bluish red; in both cases they disappear under pressure. The eruption as a whole is included under some form of erythema or roseola, the latter in syphilis and typhus. (*b*) Extravasation of blood and blood colouring matter. In this instance the maculæ remain unaltered by pressure, and change in colour gradually as absorption goes on. When in streaks they are called vibices; when punctate, petechiæ; when of larger size, ecchymoses, (*c*) Changes in the pigmentation of the skin either from excess or deficiency as in lentigo or chloasma. They may also be secondary to other inflammatory changes as in the stains left by lichen ruber planus and most syphilides. From loss of pigment arise the white spots known as leucoderma.

Papulæ—synonyms, papules, pimples—are small elevations of the skin not exceeding a split pea in size nor visibly containing fluid. They may be situated in the epidermis or the corium, and connected with the sweat, or sebaceous glands, or with the hair follicles.

Papules may be due to inflammation, as in papular eczema, going on afterwards to vesiculation and pustulation; or as in lichen tropicus where there is inflammation of the sweat glands accompanied with obstruction to the sweat secretion; or papular syphilides accompanied with papillary infiltration. Some of these latter are scaly (papulo-squamosum) and termed the squamous syphilide or syphilitic psoriasis, though they are distinct from true psoriasis. Papules may also be due to accumulation of sebum as in milium and comedo, or of epithelium as in the rare disease pityriasis pilaris which is an accumulation of epithelium in the hair follicles.

Tuberculæ—synonym, tubercles—are elevations of a nodular form in the skin due to cellular infiltration varying from a split pea to a hazel nut in size. There is no hard and fast line drawn between tubercles and tumours, but, as a rule, a tubercle is limited in size to an elevation not larger than a hazel nut.

Vesiculæ—synonym vesicles—are elevations above the surface of the skin from a pin's head to a hemp seed in size with free contents of serous fluid. They generally are inflammatory—but not so in sudamina—and are produced by uplifting of the upper layers of the epidermis by fluid. They are usually of short duration and terminate most of them by rupture as in eczema, while in others the contents dry up, become absorbed, enlarge into blebs or pass into pustules. Anatomically vesicles may be situated either between the horny layers, or between the horny and mucous layers or in the mucous layers, and may consist of one chamber as in pemphigus or of several as in herpes or varicella. Being generally inflammatory, vesicles are very often attended with burning and itching.

Bullæ—synonym, blebs—are simply large vesicles and of the same structure. They vary in size from a pea to a hen's egg, having usually tense strong walls, so that they rarely rupture spontaneously, the contents drying up. The contents are usually clear, straw-coloured, consisting of serum, but sometimes they may contain sero pus, pus or blood. Bullæ are the prominent symptom in pemphigus, are frequent in leprosy, syphilis and erysipelas, and may be present in eczema and herpes and may in fact occur occasionally in almost any acutely inflammatory affection of the skin.

Pustulæ—synonym pustules.—are vesicles that contain pus. They generally develop from vesicles or papules and are always of inflammatory origin. As a rule they are in the papillary layer, but they may be formed round the sebaceous glands as in acne; round the hair follicles as in sycosis or deep in the corium as in boils.

Pomphi—synonym, wheals—are hyperæmic swellings with a pale centre that rapidly form and as rapidly disappear. They are typically portrayed in the sting of the nettle. It is supposed that they are caused by sudden dilatation of a bunch of capillary vessels with escape of serum; they are accompanied by heat and great tingling. Some hold the opinion that the vessels beyond the point of dilatation are in a state of spasm. Wheals are characteristic of urticaria.

SECONDARY LESIONS.

Squamæ or scales are dry laminated exfoliations of the epiderms. Scaliness occurs as a secondary consequence in all inflammatory skin diseases and erythematous eruptions especially the exanthemata like scarlatina or erysipolas, when the most superficial layers are thrown off. It occurs as a more essential part of the disease in psoriasis, eczema squamosum, pityriasis rubra.

Crustæ or crusts are irregular dried masses due to the drying up of discharge, poured free upon the surface through the inflamed derma, as in eczema; or contained in bullæ; or given out by an ulcerated surface; or they may be due to sebum collected into mass; or to fungus elements as in favus. Crusts formed from the escape of serum are thin and bright coloured. Crusts formed from dried pus, are thick and yellow. Crusts from drying up of bullæ are, as a rule, thin and slightly dark. Crusts from the drying up of sanious pus from ulcers, are thick, dark-coloured, and heaped up. Sebum crusts are flat, easily detached, and greasy. The favus crust is powdery honeycombed, and sulphur-yellow.

Ulcers are the result of cachexiæ, such as the strumous or syphilitic; or of new growths replacing the normal textures, and themselves softening and decaying, as in lupus and cancer; or from softening of actual outgrowths from the skin as in fibroma and yaws.

Excoriations are lesions in which the surface is denuded of epidermis, the result of scratching. If situated in the webs of the fingers, on the front of the forearms and the thighs, they are suggestive of itch; if about the clavicles and shoulders, of phthiriasis.

Cicatrices or scars are connective tissue formations replacing losses of substance caused by injuries, caustics, and by certain diseases which ulcerate, such as variola, furunculus, carbuncle, strumous and syphilitic disease.

SECTION III.—ETIOLOGY.

The causation of skin diseases is often very obscure and complex and need not be more than touched upon here. The causes may be classified into **Hygienic** and **Constitutional** conditions.

Hygienic.—(*a*) General hygienic conditions such as climate, soil, abode and seasons. Sudden changes to heat and cold are fruitful exciting causes of eruptions. (*b*) Personal hygiene such as *occupation*. Workers in chemicals and in various special trades are liable to dermatitis in various forms, *e.g.*, working in irritating substances such as lime, sugar, flour and washing soda produces bricklayer's, baker's, grocer's and dhoby's itch respectively. *Uncleanliness* favours the growth of parasites both vegetable and animal. *Food* is an important factor. People inadequately fed and therefore in a debilitated condition are liable to skin diseases. Some foods by directly acting as irritants to the gastro-intestinal mucous membrane or by producing fermentation act as causes. As examples may be mentioned the use of starchy food in young infants which often remains indigested; the influence of beer, pastry in exciting fermentation; more direct is the gastric irritation produced in some by shell-fish exciting violent urticaria. Many *drugs*, when taken internally, may produce erythematous, urticarial or pustular eruptions, *e.g.*, bromine, copaiba, iodine, quinine, and arsenic. *Scratching* acts simply as an external irritant and may in contagious cases spread it from place to place as in scabies.

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* The etiology here followed is that of Crocker in his Diseases of the Skin.

Constitutional conditions.—(*a*) Heredity and family prevalence, *e.g.*, struma, psoriasis and warts. (*b*) Age. Speaking generally in early life there is a greater tendency to the more acute forms of inflammation and to overgrowth; in old age, to lower forms of inflammation and to degeneration and atrophic diseases. Eczema or urticaria is easily induced in infants from the ease with which the alimentary canal is irritated. Congenital syphilis generally shows itself in the first three months of life; psoriasis is not usually seen under five years; ring-worm of the head belongs for the most part to childhood; on the other hand, vegetable parasitic diseases are rare after fifty; the tendency to acne vulgaris ceases after thirty. (*c*) Dentition gets the credit of being the cause of many eruptions in infancy. It is more probable that it aggravates any disease which is present, such as eczema or urticaria instead of being itself the cause. (*d*) Puberty is a period of increased activity for the glandular and hairy systems; hence at that time, seborrhœa, comedones, acne vulgaris, bromidrosis and hirsuties are more liable to occur. At the climacteric, many diseases may appear or be aggravated, such as acne, rosacea and eczema. (*e*) Internal disease or any lowering of the general vitality is an important predisposing cause of skin diseases. Thus connected with disordered digestion more or less directly are urticaria, acne rosacea, eczema, and pruritus both general and local. (*f*) Nervous system. The connection between skin diseases and the nervous system is still obscure; at the same time, though it cannot be stated as cause and effect, the relation is an important one as, for example, in herpes zoster and in certain cases of morphœa and pityriasis rubra. The most that can be laid down at present upon this point is that the nervous system may determine the *distribution* and *intensity*, but has little to do with the *kind* of the eruption.

SECTION IV.—CLASSIFICATION.

1. Eruptions of the Acute Specific Diseases—

Embracing: The *variolous* eruption and *roseola variolosa*, *vaccinia* and *roseola vaccinia*; the *eruptions* of *typhus*, *enteric*, *rubeola*, *scarlatina*, *erysipelas*, *equinia*, and *dengue*. These are all important in reference to the differential diagnosis of the skin eruptions, but the eruption in these cases (unlike those of true skin diseases) is manifestly unimportant compared with the gravity of the general condition and the high temperature.

2. ERUPTIONS.—*The Local Manifestations of* DIATHETIC STATES—

Scrofuloderma, or scrofulous inflammation of the skin is characterized by indolent livid nodular swellings, softening into unhealthy pus, and giving place to crusting and ulceration, with general indications of struma.

Syphilodermata, or syhilitic eruptions, comprising: roseolar, papular, tubercular, squamous, and pustular syphilides; syphilitic acne, herpes, pemphigus, rupia, ulceration, gumma, &c.; these are often intermingled, and are parts only of a series of syphilitic phenomena in the way of cachexia, affections of the skin, mucous membranes, bones, and viscera.

Leprous Eruptions, consisting of dull red blotches, under which tubercles form; or red patches, becoming the seat of bullæ; or red, dry, slightly scaly, circular anæsthetic patches.

Eruptions occurring in connection with Endemic Cachexiæ, such as Delhi Boil, Aleppo Evil, yaws, &c., too special to be dealt with here.

Purpura Hæmorrhagica.

3. LOCAL INFLAMMATIONS, COMPRISING—

Erythematous inflammation; chief feature, hyperæmia in patches or diffused, and disappearing on pressure.	*Erythema* ...	With or without effusion, giving rise to soe papular or tubercular elevations.
	Intertrigo ...	In folds of skin, with muciform discharge.
	Roseola ...	Of rosy hue and patchy.
	Urticaria ...	With wheals. Eruption rapidly comes and goes.
Catarrhal, characterized by serous effusion into papillary layer running on to sero-purulent discharge and crusting; skin thin, palid, and sensitive.	*Eczema* ...	With stages of redness, papulation, vesiculation, pustulation, discharge, crusting, squamation, &c.

3. LOCAL INFLAMMATIONS, COMPRISING—*cont.*

Plastic, essentially papular; due to plastic lymph in papillary layer or deeper dermic layer. Skin generally dry and thickened.	*Lichen* ...	Papules small, pale, scattered or in circumscribed patches.
	Lichen planus...	Papules red, with flat glistening tops, separate at first, then in patches.
	Prurigo ...	Papules large, few and scattered, itching intense.
Bullous, chief feature the development of blebs.	*Herpes* ...	Bullæ small, chambered, and clustered on red base.
	Pemphigus ...	Bullæ large and isolated.
	Hydroa ...	Bullæ small, developed from papules, with pruritus.
Suppurative essential lesion pustules.	*Impetigo contagiosa.*	Pustules from vesico-pustules, superficial, painless, and isolated.
	Ecthyma ...	Pustules on a red, hard, painful base.
	Furunculus ...	Pustules deep-seated and painful, with a 'core.'
Squamous, characterized by hyperæmia and hyperplastic growth of cuticle.	*Pityriasis rubra*	Hyperæmia diffuse in derma, and flakiness affecting entire surface.
	Psoriasis ...	Hyperæmia of papillary layer, with cuticular hyperplasia, in patches.

4. HYPERTROPHIC AND ATROPHIC DISEASES—

A. *Hypertrophic.* Epithelial layer mainly affected.	*Pityriasis* ...	Branny scaliness.
	Warts, corns ...	Circumscribed change.
	Xeroderma and Ichthyosis.	Congenital disease, with altered sweat and sebaceous functions, and with papillæ often hypertrophied.
Connective tissue of the skin specially implicated.	*Keloid* ...	Contractile sessile outgrowth.
	Fibroma ...	Soft pendulous outgrowth.
	Morphœa ...	Condensation, wax-like.
	Scleroderma ...	General firm induration.

B. *Atrophia cutis Senilis atrophy Linear atrophy. General marasmus.*

5. NEW FORMATIONS—

Characteristic, being the growth of a new tissue in the form of tubercles.	*Lupus* ...	Growth soft, vascular, and composed of granulation tissue. Disease of early life.
	Xanthoma (*Xanthelasma*)	A fibro-fatty neoplasm forming tubercles in the corium.
	Cancer ...	Disease of late life; hard, indurated growth, made up of epithelial elements, or proliferating connective tissue cells.
	Rodent ulcer ...	

6. HÆMORRHAGE (CUTANEOUS)—

Effusion of blood uninfluenced by pressure, in points or in blotches *Purpura.*

7. NEUROSES—

In which the nerves are primarily disordered and there are no organic changes at the outset.	*Hyperæsthesia* ...	Excess of sensibility.
	Anæsthesia ...	Diminution of sensibility.
	Pruritus, Dermatalgia, &c.	Altered sensation.

8. PIGMENTARY ALTERATIONS—

Consisting primarily of deposits or alteration of Pigment Pigmentation. secondary to other diseases is not included here.	*Melasma* ...	Excess of colour.
	Leucopathia ...	Diminution of colour.
	Xanthoderma, &c.	Alteration of colour.

9. PARASITIC DISEASES, COMPRISING—

A. *Animal*	*Scabies* ...	due to	Acarus scabiei.
	Phthiriasis ...		Pediculus vestimentorum.
	Pruritus Eczema, &c.		Pediculus pubis. Pediculus capitis.
	Pruritus, Urticarial conditions, Erythema, &c.		Gnats, fleas, bugs.
B. *Vegetable*	*Tinea favosa* ...	due to	Achorion Schonleinii.
	Tinea tonsurans *Tinea circinata* *Tinea kerion* ...		Trichophyton tonsurans.
	Tinea versicolor		Microsporon furfur.
	Tinea sycosis		Microsporon mentagrophytes.
	Tinea decalvans		Microsporon Audouini.
	Onychomycosis		Trichophyton or Achorion.

10. DISEASES OF THE GLANDS AND APPENDAGES. DIVISIBLE INTO—

A. *Diseases of the sweat glands and follicles.*	*Hyperidrosis* ...	Excessive secretion.
	Anidrosis ...	Diminished secretion.
	Chromidrosis, Osmidrosis.	Altered secretion.
	Miliaria, Sudamina, Lichen tropicus, Strophulus, Dysidrosis.	Congestive and inflammatory.
	Sweat cysts ...	Cystic.
B. *Diseases of the sebaceous glands and follicles.*	*Seborrhœa* ...	Excessive secretion.
	Acne	Inflammation of gland with slight retention of sebum.

10.—Diseases of the Glands and Appendages. Divisible into—*cont.*

C. *Diseases of the hair and hair follicles.*	*Comedones* ...	Papules formed by accumulation of sebum in hair follicles.
	Milium ...	Accumulation of secretion in sebaceous gland.
	Hairy-nœvi, Moles Hirsuties.	Excessive growth.
	Alopecia ...	Diminished growth; partial or absolute baldness.
	Fragilitas ...	Textural alteration.
	Sycosis ...	Inflammation of follicles.

D. *Diseases of the nails,* including changes occurring in syphilis, lichen ruber, general eczema, psoriasis, pityriasis rubra, struma. Inflammation of matrix, as in onychia. Parasitic disease termed onychomycosis, caused by the favus parasite, or the trichophyton. Hypertrophy, atrophy, and corn of the nail.

This Chart is so arranged as to serve two useful purposes:—

In the *first* place, it indicates ten general groups, into which all eruptions observed on the skin may be arranged, and these groups are shown by the numbered headings on the left-hand side.

In the *second* place, the table defines the particular class to which eruptions belong, and the main diagnostic features of these classes, as well as the diseases themselves.

For instance, roseola is an erythematous inflammation of the skin in patches, and of a rosy hue. Herpes is a local inflammation of the skin, characterized by the formation of bullæ, these bullæ being small, chambered, and seated upon a red base. Pityriasis rubra is a local inflammation of the skin, characterized by hyperæmia and hyperplastic growth of cuticle, this hyperæmia being diffused generally, and the flakiness affecting the entire surface. Hyperidrosis is characterized by excessive sweating and so on.

SECTION V.—THERAPEUTICAL HEADINGS.

Local Treatment.—Whenever hyperæmia is marked or active, soothing remedies are called for, whilst the operation of irritants should be avoided, and the air excluded; and not until the stage of hyperæmia is passed should stimulating and other remedies be used.

General Treatment.—The following conditions must be taken into consideration in framing the internal treatment of these inflammatory diseases, it having been settled first of all whether or no the disease is uncomplicated :—

Influence.	*Its action.*	*Specially observed in*	*Treatment.*
Debility, including anæmia.	It retards recovery from want of recuperative power in the system. All functions share in the debility.	Furunculus. Eczema. Pityriasis rubra. Pemphigus. Ecthyma.	Tonics. Mineral acids. Iron. Quinine. Cod oil. Arsenic. Food.
Dyspepsia ...	Induces debility. Leads to liver disturbance. Impurifies blood current. Increases hyperæmia by reflex action (acne).	Eczema. Urticaria. Acne. Sycosis.	Antacids and bitters. Regulation of diet. Fresh air.
Retention of excreta from kidney, liver, and bowel inactivity.	Gives the blood an irritative quality and aggravates hyperæmia.	All inflammatory skin diseases.	Quicken elimination by diuretics, aperients, and cholagogues.
	Leads, in the case of kidney torpor, to increase of watery fluid in tissues.	Eczema of legs.	Diuretics.
Constipation ...	Gives rise to dyspepsia. Liver torpor. Retention of excreta.	All forms.	Aperients.
Diabetic state ...	Increases inflammatory character; favours phlegmonous inflammation, and leads to freer development of disease, and to chronicity.	Eczema. Psoriasis. Intertrigo in adults. Furunculus. Anthrax.	Anti-diabetic.
Repression of special normal eliminatory functions, renal, and menstrual.	Compensatory elimination demanded of skin, which may fail to respond, and so become diseased. In dependent parts this leads to increase of fluid in tissues.	Furunculus. Ecthyma. Eczema.	Vapour and other baths. Sudorifics. laxatives, and tonics.
Gouty and rheumatic diathesis.	Causes accumulation of uric and lactic acids and allied compounds in blood, giving an inflammatory character to disease by increasing hyperæmia.	Eczema. Psoriasis. Lichen. Ecthyma. Sycosis. Urticaria.	Gouty remedies, combined with those appropriate for the skin disease.
Strumous diathesis.	Imparts an unusual purulent character to eruptions, and favours implication of connective tissue.	Eczema. Psoriasis. Acne. Sycosis.	Cod-liver oil always required.

Influence.	*Its action.*	*Specially observed in*	*Treatment.*
Syphilitic taint.	Tends to induce induration from presence of syphilitic tissue; or ulceration, cachexia and general debility.	Eczema. Psoriasis. Pemphigus. Ecthyma. Acne. Intertrigo (infants).	Anti-syphilitic remedies must be combined with others, or used in first instance alone. General tonics needed.
Diet, errors of.	Introduces special irritative substances into blood; causes dyspepsia; leads to accumulation of nitrogenous matters in system, to liver disorder, &c.	All forms of inflammatory eruptions without exception.	Regulation of diet according to circumstances.
Hygiene, lack of.	Disposes to torpor of skin, and favours occurrence of morbid action and disease.	Acne and sycosis. Eczema. Intertrigo. Erythema especially.	The use of baths, ablutions, proper clothing, and the like.

These several conditions or influences exists in varying combination, just as do the component elements of the causes of many skin diseases, and the skill of the physician is shown in estimating aright this combination in its different details in any given case, for upon this the treatment must be based. One illustration will suffice; eczema may occur in a gouty and dyspeptic subject, whose blood-current is unduly charged with nitrogenous excreta, and who has been indulging too freely in stimulants.

It will be observed how many of the influences referred to in the chart increase hyperæmia of the skin. No hyperæmia must, before anything else is attempted (especially when it is active in character) be repressed; and this may be done partly by local means, before referred to, by augmenting the action of the kidneys, and by preventing the operation of those influences that increase hyperæmia. This is the most important point to be attended to in the early treatment of inflammatory skin diseases, because generally all that is needed afterwards is the exhibition of tonics internally, and the use of astringents and stimulants locally. Consequently alcohol, if given at all, should be given sparingly in as much as it dilates the vessels of the skin and increases the hyperæmia.

CHAPTER XIII.

THE EXAMINATION OF THE EAR.

Preliminary enquiry.—Morell Mackenzie used to say that no surgeon should consider himself an authority on diseases of the ear, unless, in addition to a special acquaintance with the ear, he had been brought up a general practitioner for at least ten years. This places the point he wished to emphasise in very clear relief, *viz.*, that, in dealing with ear disease in general, it is not merely the local affection in the ear that has in many cases to be attacked, but a dyscrasia in nutrition, a constitutional enfeeblement, may be even an inherited disability, that the surgeon has to consider and to treat before any improvement in the auditory apparatus can be hoped for. Consequently, in most cases that present themselves, the following points must be ascertained:—

(1) Age, habits, residence.

(2) Duration of the disease, the circumstances under which it arose, and its subsequent course.

(3) The general health of the patient, making special enquiry as to the past history of the patient in regard to diseases from which he may have suffered, especially measles, ague, mumps, syphilis, whooping cough, throat troubles, and, in the case of Europeans from the West, scarlet fever and diphtheria.

(4) The family history in regard to ear affections.

(5) The influence of environment on the disease, *e.g.*, the weather, whether the ailment is aggravated or improved by certain changes in it.

(6) The effects of exercise, especially where there are noises (tinnitus) in the ears.

(7) The existence or not of pain, tinnitus, giddiness (vertigo), vomiting.

(8) Whether there has been any discharge from the ear, and, if so, its duration and nature.

Having noted these points so far as they bear on the case in hand, the ear should next be examined systematically.

Examination of the ear.—Any deformity of, or the presence of, any eruption in the external ear should be noted; also the presence of any discharge, noting its quality in regard to consistence, color and odour. Note the presence or absence of redness, or swelling with narrowing of the orifice of the meatus, also whether there is tenderness of the mastoid bone, or immediately in front of the ear. These points can be observed at a glance.

The interior of the auditory canal, and the condition of the membrana tympani should next be investigated. To effect this, it will be found that in many cases no apparatus is necessary. In these cases the canal will be found wide and easily straightened so as to give a view of the drum by merely pulling somewhat fixing on the pinna in a direction vertical to the side of the head.

In many cases, however, this cannot be done. Either the canal is so narrow or the ear is so painful that straightening of the canal by pulling on the pinna is impossible. For these cases speculums are necessary. Of these there are many, and Brunton's is, in my opinion, by far the best for use in this country. I always use it with the magnifying eye-piece removed, as one thus gets a view of the conditions present in their natural size. No mirrors are required, or lamps during bright daylight. It is always best, if possible, to examine the tympanum by daylight.

Brunton's speculum requires a little practice to enable one to use it efficiently. A good plan is to practise looking at the hairs on the back of the hand. The student will thus very soon acquire the secret of its mode of use, which is that the patient's ear must be made to fit on to the speculum, not *vice-versâ*. Of simple speculums Dalby's is the best, but, like all except Brunton's, a reflecting mirror is essential for the making of .a thorough examination. Kramer's also is an excellent all-round instrument, in using which. however, the student must always be careful not to exercise too much pressure on the walls of the auditory canal in his efforts to get a view of the drum. Any one who cannot use speculums without causing pain had better give up the use of them altogether. The student must be prepared for the patient coughing violently on the introduction of a speculum to his ear—a reflex cough, due to irritation of the auricular branch of the vagus nerve.

As the speculum enters the auditory canal, wax or fungus (especially *aspergillus niger*) not otherwise visible will often be encountered, and must be wiped out before the examination proceeds further. Soon the membrana tympani comes into view, set obliquely to the axis of the speculum. In the natural light, such as I have recommended, if normal, it will present a highly polished surface of a pearl-grey colour, the polish being, as a rule, more perfect in adults than in children on account of the thick outer layer of the membrane in the latter. Indeed, the healthy drum is often quite dull and opaque in children, a point to be borne in mind, otherwise, a degree of meningitis (inflammation of the drum) or of congestion may be thought to exist.

A curious condition sometimes encountered is a very transparent drum through which the promontory of the tympanum may be seen. This is due to extreme thinness of the outer layer of the membrana tympani, and is very puzzling at first.

The pearly colour is probably always most marked on the anterior portion of the drum. In very old persons the drum not uncommonly loses its polish and presents a uniformly dull grey tint.

Near the upper part of the circumference of the drum is a prominence caused by the short process of the malleus, looking like a yellowish white knob projecting into the auditory canal. From this knob a pale yellowish ridge (often a mere streak) due to the attachment of the handle of the malleus runs downwards, backwards and slightly inwards, and terminates in a rounded or flattened extremity in the lower half of the membrane at a depression called the *umbo*. From this point running downwards and forwards almost to the periphery is an elevation of the membrane, triangular in outline, which reflects the light very strongly, hence called the "cone of light." The apex of this "cone" is below and in front of the *umbo*, its base close to the periphery of the drum. The membrane at the *umbo* is always markedly opaque owing to the presence of cartilaginous cells round the inferior extremity of the handle of the malleus (Politzer).

The measure of hearing.—Having noted carefully all deviations from this type, the student should next ascertain the exact degree of hearing. There are several ways of doing this, but the handiest is by means of **a watch.** In this land of shrieking crows and squirrels and open doors, an ordinary watch is heard at 36." But before using a watch as a test of hearing, the normal hearing distance for that watch should first be ascertained. Suppose it is 36," and the patient can hear only 2" off, you enter the degree of hearing as $\frac{2}{36}$ L, or R (left or right) as the case may be. If there is complete deafness enter $\frac{0}{36}$; if the watch can be heard only when placed in contact with the ear enter $\frac{c}{36}$. In using the watch, the patient's eyes must be closed, and the watch brought gradually towards the patient's ear, and the distance noted at which he begins to hear. This should be done with infinite care, as patients often pretend to hear when they do not. The process has therefore to be repeated over and over again. *Never try any remedial measures till the hearing power has been carefully ascertained.* This will save the student from being accused by the patient of having ruined his ears by the treatment adopted. It will also ensure him the credit of whatever improvement in hearing he may bring about.

Other means for ascertaining the degree of hearing are—

(i) **Politzer's hormesser or acoumeter.**—This is superior to a watch from the fact that it always produces the same loudness of sound. A watch varies in loudness according to the time that has elapsed since last winding. The acoumeter consists of a steel sounding tube and a hammer attached to a bar, and so arranged that the hammer can be made to strike the tube at pleasure.

(ii) **Hughe's sonometer.**—This is a combined microphone and telephone, and its chief value lies in the facility with which, by its means, variations in the hearing power may be detected.

(iii) **Galton's whistle.**—This is an instrument used in testing the hearing power for very high notes. It may be stated generally that, in affections of the middle ear, the perception of high notes is frequently retained, while in those of the internal ear, perception of low notes is retained. There are, however, exceptions to this sufficiently numerous to render the use of the 'whistle' much less practically valuable than was at first anticipated.

(iv) **Speech.**—Speech must be regarded as the most important test of hearing power. To hear **speech** is that for which deaf persons usually consult the surgeon. When testing hearing by this means, it should be borne in mind that deaf persons sometimes spontaneously acquire a wonderful capacity for lip reading. Their eyes should therefore be kept closed during the examination, and to be quite sure the patient does hear what is said, he should now and then be asked to repeat it. It is a curious fact that some patients who hear the tick of a watch only when placed close to the ear, may hear a whisper some yards away, while others may hear the watch some way off, yet will not hear speech unless the mouth is applied close to the ear. These variations are no doubt due to the destruction, in the auditory apparatus, of those parts which register certain sounds and the preservation of those which register certain other sounds. In testing the hearing power by speech, it is not wise to ask the patient questions and then *conclude* he hears what is said, because he answers the questions intelligently. He may only catch one or two words, from which he will guess correctly what the rest of the sentence was. It is best to pronounce certain words distinctly and ask the patient to repeat them. Nor should the surgeon raise his voice too much. If he does, only the vowel sounds will reach the patient's ear, the consonants will be usually lost, so he will fail to understand what is said.

(v) **The tuning fork.**—For diagnostic purposes six forks are required, corresponding with the notes c, c^1, c^2, e^3, c^4 and q^4 respectively. The fork is not much used for determining the power of hearing at a distance, but mainly as a test of the perception of vibrations, or sonorous undulations conducted to the ear through the cranial bones.

Bone-conduction of sound.—When a vibrating tuning fork is placed on the cranium, the vibrations reach the labyrinth by one of two routes, viz., directly through the solid intervening parts, and indirectly by transmission along the bones to the membrana tympani, ossicles and internal ear. If the vibrating fork be placed on the vertex and both ears closed, the sound is intensified if the ears are normal. If, however, there be nerve deafness of one ear, the sound will be intensified in the healthy ear, but not in the affected ear. In some affections of the external or middle ear, the vibrations are intensified without closing the ear. It requires great patience *on the part* of the surgeon and a fair amount of intelligence on the part of the patient to carry out these investigations in bone-conduction of sound satisfactorily.

Large tuning forks yielding middle and low notes are the most useful for testing bone-conduction. I have no space to go into the subject of bone-conduction fully, but would refer the student to the English translation of Politzer's work, third edition.

The Eustachian air douche.—This is an instrument used either as a remedial agent, or merely to ascertain whether the air-way between the pharynx and middle ear is obstructed or not. It consists of a rubber tube having a rubber bag at one end and a rubber nozzle to fit the anterior nares at the other. In order to use it, the nozzle is fitted into one of the nares (sometimes, as in Allan's pattern, it fits over both nares), the patient takes a little water in his mouth, and is directed to swallow. At this moment the surgeon closes the free nostril and presses the air-bag firmly and quickly. The air will find its way through the Eustachian tubes, if they are permeable, to the middle ear. It is well to use an **otoscope** at the same time to check the patient's sensation of air being felt rushing into the ears. An otoscope is a rubber tube two and-a-half feet long, with an ear piece at each end, one generally black, the other white, so that the surgeon may always know which end he uses for his own ear.

The Eustachian catheter.—Sometimes it is necessary to use the Eustachian catheter, if one would secure the entrance of air into the middle ear. This instrument is like a diminutive *Catheter á conde*, made of metal or vulcanite. To pass the tip of this instrument into the Eustachian tube without worrying the patient requires a little practice. The best way to learn the method is decidedly on the *Cadaver*, having cut away the skull just below the level of the roof of the pharynx. In the living subject the instrument must be used with infinite gentleness. It is taken in the right hand, its tip oiled, and passed into the nares, its axis at right angles to the face, its tip close against the floor of the inferior meatus. Soon it will be felt to be arrested against the posterior wall of the pharynx. When this is felt, the tip is turned directly outwards and drawn from behind forwards along the side of the pharynx. When it has come forward about half an inch, it will be felt as it were to jump over a hard resisting ridge. It is then in the trumpet-shaped orifice of the Eustachian tube. The nozzle of the Eustachian air bag may now be inserted in the proximal end of the catheter and air gently forced in. It is sometimes necessary to spray the nares with a 2-per cent. solution of cocaine before the patient will submit to this process with resignation. A patient can generally be taught inflate the middle ear simply by closing the nostrils tightly with his finger and thumb, and then, having firmly closed the lips, puff out his cheeks and nostrils strongly. This is sometimes a very useful method of confirming the existence or not of a perforation in the drum. Not unfrequently there is a perforation in the drum which at first cannot be seen, but whose presence is suspected by a tell-tale-bit of mucus apparently in the surface of the drum but which cannot be wiped off. It is really a bit of mucus projecting from the middle ear through a perforation in the drum. Sometimes it will exhibit a rhythmic movement, synchronous with the heart's beats, and when this is the case its nature is certain; but if it is motionless, inflation of the middle ear by the process above described will generally force it and perhaps an air bubble through the perforation, and at once reveal the hole in the drum; or the patient's head being placed so that the diseased ear is uppermost, the meatus is filled with warm water, and the inflation is then effected; air bubbles will immediately be seen at the meatus, and then, on again using the speculum, after wiping the parts dry, the perforation will be very clearly seen, washed out clean.

CHAPTER XIV.

THE EXAMINATION OF THE THROAT AND NOSE.

Methods.—A complete examination of the throat should include (i) a direct examination by the eye, aided only with a tongue depressor; (ii) an exploratory examination with the fore-finger; (iii) a laryngoscopic examination.

1. **The direct method.**—The patient should face a good light; if this cannot be had, the light of an ordinary good table-lamp may be reflected into the throat by a mirror. The patient should be asked to breathe deeply, and utter the exclamation "Ah!" by which the faucial aperture will be widened considerably. The tongue may then be depressed with a depressor, or it may be drawn out of the mouth by the tip.

The following points should be noted:—

(i) any alteration in shape of faucial aperture;
(ii) any alteration in colour of the faucial pillars, tonsils or pharynx;
(iii) any staining, ulceration, new growth, or cicatrix;
(iv) the state of the post-pharyngeal mucous follicles;
(v) the presence of any secretion and its character.

2. **Digital exploration.**—If the direct inspection has revealed a condition of tenderness of the throat, it will be well now to spray the throat with a 2-per cent. solution of

cocaine. The digital exploration should be done with all gentleness and deliberation. The Surgeon should stand in front of his patient, the latter seated on a chair of convenient height. The right side of the throat should be examined with palmar surface of the right fore-finger, the left side with the corresponding surface of the left forefinger. The finger should not at first be passed at once into the pharynx; this would be certain to excite resistance on the part of the patient; it should be placed against the hard palate, and glided thence into the throat over the faucial pillars. On its way, the valecula, pillars, tonsil, peritonsillar fossa, side of the pharynx, and the pyriform sinus, should all be carefully explored in succession. The finger may now be withdrawn, the patient allowed a few moments to recover and perhaps sip a little cold water, and asked if he is ready for another examination. He usually assents, somewhat reluctantly perhaps, and the Surgeon re-introduces his finger. This time he glides it along the old course but more rapidly, and seeks at once the *fossa innominata*—the space between the edge of the vocal cord and the aryteno-epiglottidean fold. This should be done rapidly, as the patient feels as if he was being suffocated. The finger is then passed into the œsophagus as low as the cricoid cartilage and the examination is complete.

This examination is chiefly of use in the detection of foreign bodies, but the presence of œdema, or of new growths may also sometimes be detected.

3. **Laryngoscopy.**—A description of how to use the laryngoscope is hardly worth the paper it is written on. The student must learn the method from a teacher, or by auto-laryngoscopy, and he must in addition practise the procedure frequently. A few hints may, however, be useful.

The student should begin to learn in the dark room with a proper lamp if possible. But any darkened room and any good table lamp will do perfectly well. Let him first practise reading words from a page placed horizontally, and on the level of the eye, by means of the laryngeal mirror. This will give him some notion of the angle at which the mirror must be held in the pharynx. It will also give him some notion of the position his own head should occupy relatively to the patient's during an examination. This is the greatest difficulty in the way of the tyro. He will perhaps succeed with one patient, but fail utterly with the next, forgetting that the spinal column of the new patient is perhaps 6 inches longer or shorter than that of the old one, and that he should alter the level of his seat accordingly. This variation in spinal length is got over in other ways by the experienced—by those who have learnt the "art." Practice alone can teach them.

The *beginner* should always spray the patient's throat with 2-per cent. solution of cocaine. This will prevent the patient resenting clumsy handling of the laryngeal mirror, whereby the sensitive posterior wall of the pharynx is usually so irritated that the patient cannot tolerate the examination. The expert seldom requires to cocainise the throat except in the case of children and a few women.

A routine laryngoscopy is performed as follows:—The patient is seated with his back towards a good lamp, the Surgeon seated facing him with the reflecting mirror on his forehead, or, if he uses the perforated mirror, over one eye. The light from the lamp should fall on the mirror over the patient's left shoulder, and when reflected should throw a disc of light about 1½ inches in diameter into the patient's throat when he opens his mouth, so that the posterior wall of the pharynx can be distinctly seen. The Surgeon now takes a clean rag between his left fore-finger and thumb, grasps the tip of the patient's tongue and draws it out, but not so far or so strongly as to hurt the *frenum linguæ* on the incisor teeth. With his right hand he grasps the laryngeal mirror and, having heated it in a spirit lamp flame for a few seconds, to a degree that allows him to hold it comfortably against his cheek, he passes it into the patient's throat, avoiding touching the posterior wall if possible. During his first independent trials, the tip of the epiglottis, the vallecula, the adenoid tissue in the neighbourhood, and the circumvallate papillæ will probably be all that he will see. But let him persist: difficulties will vanish gradually: a view of the posterior surface of the epiglottis, the vocal cords, and even the rings of the trachea, will finally repay him for all his trouble.

The general appearance and relation of the parts in the throat and larynx are best learned in the anatomical theatre, and by the examination of some living subject whom it does not distress. The living parts present the following colours in health; the lingual surface of the epiglottis appears of a yellowish or pinkish drab colour; its upper border is decidedly yellow; its laryngeal surface, especially the cushion, varies from a pinkish yellow to a deep pink, sometimes it appears quite red—so bright indeed, as to suggest the idea of the existence of an inflammatory condition. The arytæno-epiglottidean folds are pale pink, they have been described as about the same colour as the gums. The mucous membrane covering the arytænoid cartilages is also pink, but of a somewhat deeper tint. The false vocal cords are perhaps a slightly deeper pink still. The true vocal cords are distinguished by their glistening pearly whiteness, but sometimes they are slightly greyish. The cricoid cartilage is recognized by its well-marked yellowness. The tracheal cartilages appear of a yellowish drab colour and between them the mucous membrane is pale pink—(Durham). The points to be observed are changes in colour, ulceration, tumefaction, tumour, foreign bodies, and the movements of the true cords.

Rhinoscopy or examination of the nasal cavity is of two kinds—anterior and posterior.

Anterior.—Having introduced a bivalve or wire speculum the light is thrown into the anterior nares as in laryngoscopy, the relative positions of the Surgeon and patient are also the same as those for laryngoscopy. A considerable portion of the septum which is frequently deflected to one side will be seen; the inferior turbinated bone covered with bright red mucous membrane will appear as a nearly globular swelling which is not infrequently mistaken for a polypus; the floor of the nose appears as a slightly excavated groove.

Posterior.—This is a difficult procedure, in some patients an impossibility. The smallest laryngeal mirror is introduced into the back of the throat between the anterior pillar of the fauces and the uvula, on one side first, then withdrawn and placed in the same position on the other side. It should be held so that the plane of its reflecting surface forms with the horizon an angle of 130 degrees. In this way with the light reflected from the larger mirror on his forehead, the observer will be able to inspect the whole of the posterior nares, and by first slanting the mirror a little towards one side, and then towards the other, the orifices of the Eustachian tubes will become visible. The above examination is facilitated by painting the soft palate with a 2-per cent. solution of cocaine.

The Surgeon's finger should be familiar with the feel of the posterior nares, and of all that is within reach behind the soft palate. To carry out a post-nasal digital exploration properly it is of importance to put the patient in a stout chair as he will involuntarily struggle considerably. It is generally advisable to cocainise the parts before attempting the process. This method of examination should be carefully and repeatedly practised on the *cadaver* by the beginner. For this purpose the skull and roof of the pharynx should be cut away, so that the student can see the parts while he is examining them with the finger introduced through the mouth.

CHAPTER XV.

CLINICAL EXAMINATION OF DISEASES OF THE EYE.

When recording a case of eye disease, the following points merit notice, regarding which existing facts should be noted, in addition to those furnished by the patient. It sometimes occurs that most of the latter have passed away as the time of the examination by the student without leaving any evidences of their former existence.

The outward bearing of the patient.—(*a*) Note whether he is intolerant of light or in other words suffers from photophobia as a symptom; (*b*) whether lacrymation is present; (*c*) whether the eyelids are kept closed and at the same time shaded by the hand, or whether they are widely opened; (*d*) whether the head is maintained in an erect position, or is depressed with the chin resting on the sternum; (*e*) when standing or walking, note whether there are any evidences of impaired nervous function in any of the organs of locomotion; (*f*) judge by the external appearances of the patient whether pain is present or not.

The eyelids and external parts surrounding the orbit.—Note as regards the *latter*, (*a*) the presence or absence of cicatrices from wounds or from herpetic eruptions, or form small-pox and (*b*) any evidence of former treatment as blister-marks, leech bites, or seton marks.

As regards the *former*, (*a*) the presence of swelling whether general to both eyelids, or whether limited to one eyelid;

(*b*) the condition of the tarsal margins, and the presence of scabs, or of concretions at the roots of the cilia ; (*c*) as to the direction of the edges and whether deprived of the cilia or otherwise ; (*d*) the presence of any tumor in the structure of the lids ; (*e*) whether the puncta lacrymalia retain their normal position or not ; (*f*) the state of the canthi and the caruncles ; (*g*) the presence of a tumor occupying the position of the lacrymal sac ; (*h*) whether any discharge exudes from between the margins of the eyelids and its nature.

N.B.—*The investigation up to this point can be conducted during a conversation with the patient or his friend, without a manual examination of the parts.*

The conjunctiva and cornea.—Note (*a*) the condition of congestion or otherwise, and whether associated with ciliary congestion ; (*b*) the secretion, if any, on its surface and its character ; (*c*) the dryness of the membrane ; (*d*) the presence of any growth, such as pterygium or polypus or wart ; (*e*) the presence of pustules.

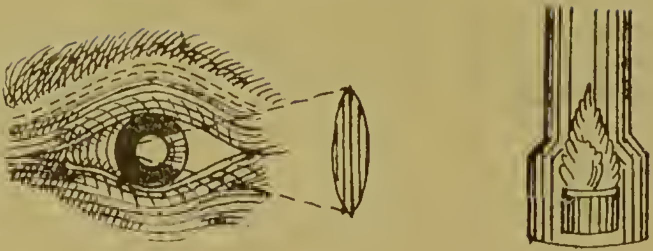
N.B.—*At this point close the eyelids and ascertain the tension of the eyeball by palpation, and note whether there is a + or — degree present, or whether it is normal. Next evert the eyelids for the examination of the palpebral conjunctiva, and the retrotarsal folds. Note the following fact in regard to these parts :—*

(*a*) The condition of the surface of the membrane as to the existence of papillary granulations or trachoma ; (*b*) as to cicatricial tissue ; (*c*) the lodgment of any foreign body in the retrotarsal folds ; (*d*) the signs of meibomian cystic tumours, or calcareous deposits in the meibomian ducts.

The cornea—(*a*) carefully note its transparency and the smoothness or roughness of its surface ; (*c*) the presence of vascularity pannus—or of ulcer ; (*c*) the lodgment of any foreign body, as dust, iron or glass, on its surface or impacted in its structure ; (*d*) the presence of phlyctenulæ, or their sequelæ as opacities from cicatrisation ; (*e*) the presence of staphylomata whether partial or complete ; (*f*) wounds or injuries accidently or purposely inflicted.

N.B.—*For the more complete examination of this and the deeper structures, the oblique method of examination is useful and almost indispensable.*

FIG. 3.



The oblique or focal illumination.—'SOELBERG WELLS.'

The Iris.—(*a*) record the state of contraction or dilatation of the pupil, and whether such state is of a temporary or permanent character; (*b*) the mobility of the pupil under the influence of light; (*c*) the depth or shallowness of the anterior chamber; (*d*) the presence of anterior or posterior synechiæ; (*e*) the appearances of the stroma of the iris, as to the distinctness of the muscular fibrillæ, the condition of the blood vessels together with the presence or absence of the congested ciliary vessels around the corneal circumference; (*f*) the existence of plastic or syphilitic deposits on the anterior surface or in its structure, or of the formation of cystic or other tumours; (*g*) as to any congenital absence in part—as coloboma—or its rupture either in its continuity or at its ciliary margin—iridodialysis.

The lens and its capsule—(*a*) as to their transparency or otherwise; (*b*) the character and situation of any opacity to whether central or peripheral; whether at the poles or at the equatorial region; (*c*) as to the opacities being in the form of specks or lines; (*d*) whether limited to the lens or involving the capsule; (*e*) the history of the patient for the determination of the congenital or senile forms, or to determine its idiopathic or traumatic origin; (*f*) position of the lens whether dislocated partially or completely in any direction; (*g*) the existence of any wound to the capsule or the lens structure.

N.B.—*Examination by the oblique illumination and by the ophtholmoscope with the previous instillation of atropia facilitates the investigation of the case.*

Post-ocular diseases.—These include diseases of the vitreous, retina, optic nerve, choroid and sclerotic coats, and the posterior part of the eyeball. Besides the general subjective symptoms furnished by the patient, some of which are common to each and all of these structures, the objective signs must be made out by the aid of the ophthalmoscope, in order to define and limit the diseased action to one or more of the deeper structures.

In all these diseases the visual power is more or less impaired. Note, therefore, (*a*) by a rough method the degree of vision at distance for any large object held before the patient; and (*b*) in a more exact manner by means of test types—Snellen's or Jager's; (*c*) the extent of vision may be estimated by the use of a perimeter; (*d*) the abnormal refraction—myopia, hypermetropia, astigmatism, or presbyopia—by special test objects.

The Ophthalmoscope.—The form of instrument in most frequent use consists of a small concave mirror having a small orifice perforated at its centre, and set on a handle. Together with the mirror is a biconvex lens of about 2¼ inches focal power. In other forms of the instrument, a number of concave and convex lenses are attached to the instrument and so mechanically arranged that any particular lens can be placed behind the mirror at will. These are useful in determining any abnormal refraction in the examined eye, or to correct any form of ametropia in the eye of the observer.

Method of using the instrument.—The instrument may be used in two ways, viz., by employing the mirror alone, and by using in addition the 2¼ convex objective lens. The former method is called the *direct method*, and the latter the *indirect method* of examination.

Direct method.—The patient being seated opposite to the observer whose head must be on a higher level, and a lamp having been placed on a table to the left of the patient on a level with his left eye and somewhat behind his head, the rays of light from the lamp are received by the ophthalmoscopic mirror which is held in the right hand, and are reflected into the eye under observation. The observer at this time, on looking through the central orifice in the mirror, will notice an orange-red reflection from the fundus of the patient's eye if a European, and a darker reflection if a native. In the examination of the left eye, the patient should look at the left ear of the observer, and in examination of the right eye, at the right ear of the observer. The eye when so directed will expose to illumination the optic disc.

As soon as the red glow is visible, the observer advances his eye gradually towards the patient's eye until he approaches it to about two or three inches. If the refraction of the eyes of both patient and observer is normal—emmetropic—an upright image of the fundus, magnified by the crystalline lens of the patient's eye, will be clearly seen, and the optic papilla with the arteries and the veins proceeding from and to it as a centre can be distinctly seen, the arterial vessels being smaller in calibre, lighter in colour, and bounded by a double contour; the veins being wider, darker in colour, and devoid of the double marking. Any movement of the head of the observer to the right or left causes an apparent movement of the illuminated fundus in the same directions.

If the eye of either the patient or observer be ametropic in the direction of hypermetropia, the erect image of the fundus will be visible at any distance beyond two or three inches, according to the degree of the error of refraction present. Movement of the observer's head to the right or left in this case will also produce apparent movements of the illuminated fundus in similar directions.

Again, if the eye of either observer or patient is ametropic in the direction of myopia, an inverted image of the fundus will be obtained at any distance beyond three inches from the eye under examination, according to the degree of the existent myopic refraction. In this case, the movements of the observer's head in one direction causes an apparent movement of the fundus of the patient's eye in the opposite direction.

In astigmatism, whether myopic or hypermetropic, simple or compound, the same rules obtain as regards the distance at which the details of the patient's fundus become visible.

If the observer suffers from ametropia in any of its forms the necessary correction must be made by means of appropriate convex or concave lenses fixed behind the mirror of the ophthalmoscope. The *direct method* is most useful when a limited and enlarged view of a portion of the fundus is required to be made. This is the more difficult method of examination for beginners in the use of the instrument.

Indirect method.—The rules as laid down for the examination by the direct method hold good here. In addition, however, the $2\frac{1}{4}$ bi-convex lens which is in the ophthalmoscope case must be employed in the *indirect method.* While a steady light is thrown into the fundus from the mirror, the bi-convex lens is taken between the forefinger and thumb of the left hand of the observer, and resting the little finger on the brow of the patient over the eye undergoing examination, the rays of light reflected from the fundus of the patient's eye are condensed and an inverted image—ærial—becomes visible. This image is situated between the ophthalmoscopic mirror and the bi-convex lens.

The ametropic condition of the patient's or observer's eye does not affect, in any material degree, the picture so obtained.

This method of examination is useful in those cases in which it is necessary to obtain a view of a larger surface of the fundus than can be got by means of the direct method.

The difficulties—if they can be so called—in prosecuting this method of examination consist in the harmonious action of both hands in the manipulation of the mirror and the biconvex lens. As the image is an inverted ærial one, every movement of the hand holding the bi-convex lens will cause an apparent movement of the fundus in an opposite direction.

CHAPTER XVI.

EXAMINATION OF THE RECTUM.

Prior to a thorough examination of the part, the bowel should be unloaded by an aperient on the previous day, and by an enema on the morning of the examination. The patient should then be exposed in a good light, the best position being the lithotomy posture slightly modified. The patient lies on his back with a pillow under the sacrum, the thighs are fully flexed and the patient's hands locked under the popliteal regions. With the palms of the observer's hands placed on the buttocks, the parts are still further exposed. Instead of the above, the kneeling posture may be adopted. In the case of females the lateral posture has to be adopted. In this the patient lies on one side with the legs well drawn up and the thighs flexed upon the abdomen, the hips being brought to the edge of the bed or couch in a good light. With one hand, the observer, having uncovered the parts sufficiently to expose them, may then raise the upper buttock, and in doing this the anus comes well into view. By inspection, abnormal conditions, such as warts, condylomata, fissures, piles, fistulæ or abscess may be seen. Fulness, induration and pain on one side are indicative of ischiorectal abscess. By drawing open the anus and directing the patient to bear down, a good view will be obtained of the muco-cutaneous junction.

Pendulous loose folds of skin about the anus will suggest the former existence of external hæmorrhoids; blue turgid venous projections, their present existence. A tightly contracted and rigidly drawn up anus, as a rule, means some painful ulcer of the part, and a patulous anus through which flatus or discharge passes without the patient's wish, too often means extensive rectal ulceration or stricture. Internal piles, when prolapsed, will appear as turgid, vascular, mucous projections, surrounded by everted integument, more or less œdematous and covered with mucus or blood. Prolapsus recti presents itself as a greater or less annular projection of smooth or rugous mucous membrane with a central intestinal orifice. A polypus projecting will appear like a cherry surrounded by healthy structures. All these points are taken in at a glance and interpreted.

A digital examination is then to be employed to confirm or refute the suggestions thus taken in by the eye. To do this well, the index finger and, if necessary, the second finger, should be thoroughly oiled (it being a good plan to previously fill the nails with a little soap), the index finger should then be applied to the anus and the patient told to bear down, in doing this the sphincter is relaxed. The observer may then with ease and without causing pain introduce his finger. The thicker the oil used the less pain will be caused to the patient.

In a digital examination of the normal rectum the following points may readily be made out:—

1. **In the male**—The entrance to the anal canal is marked by a ridge, and immediately above this are the anal valves. Posteriorly the coccyx, lower part of the sacrum and sacro-sciatic ligaments are felt. Enlarged lymphatic glands

when present are felt in the hollow of the sacrum. Laterally the ischio-rectal fossæ can be examined and the tuberosity of the ischium felt. In front the prostate can easily be felt, and anterior to it is a pouch through the centre of which the urethra can be made out when a catheter is passed. Above and behind the prostate the bladder can be felt, with, possibly, the vesiculæ seminales on each side.

2. **In the female**—The posterior and lateral relations are the same as in the male. In front the cervix and os uteri, and above them the body, and the fundus of the uterus can be felt.

When an ulcer exists at the anus, pain will be caused by, and there will be spasmodic resistance to, the introduction of the finger. With the pulp of the finger, slowly moved round the anus, the ulcer will probably be felt. It should be stated, however, that in many cases such ulcers will be seen by the careful drawing down the skin of the anus till the margin of the mucous membrane becomes visible. A spongy nodular feel of the mucous membrane just within the sphincter will suggest internal hæmorrhoids; a local, tender and raw surface will be probably a syphilitic sore, while a cancerous ulcer is known by an infiltrated, nodular, and thickened surface. A stricture within two inches of the sphincter can always be detected by its annular form or the obstruction which it causes. When a healthy piece of bowel separates the anus from the stricture or from ulceration, the probability of the disease being cancerous is rendered great. Where no such healthy tissue exists, syphilitic disease is probable. A digital examination will always detect the presence of scybalæ or impacted fæces, and also the encroachment of uterine or pelvic tumours in women, and prostatic tumours in men. The introduction of the second as well as the index finger sometimes permits of a greater range of exploration. A general smoothness and absence of the normal folds indicates atony. In examining for polypi the investigation should be conducted from above downwards, as otherwise the tumour may be pushed up out of reach. In examining for internal hæmorrhoids it must be remembered that unless they have previously been thickened by inflammation, they are to be recognized by the touch. In some cases examination is facilitated by distending the rectum with warm water by means of an enema. If the disease is situated high up, the patient may be made to stand up and directed to make an expulsive effort.

Should a digital examination fail to give sufficient information, examination by means of a speculum must be practised. If the introduction of a speculum be necessary, an anæsthetic should, if possible, be administered. The patient should be placed in the lithotomy position by means of Clover's crutch. In many cases, especially when the examination is to be followed by immediate operation, it will be better to commence by dilating the sphincter. This operation is performed by introducing both thumbs beyond the sphincter, the other fingers being laid flat over the buttock on each side. Then, by firmly grasping the tuber-ischii on each side, the anus must be gradually, but firmly, dilated. A great variety of specula are in use. Whatever instrument be used, it should be well oiled before introduction, and a good light, either natural or artificial, will be required.

When the disease is situated high up in the rectum, great difficulty may be experienced in making a diagnosis. In some cases specially constructed bougies are of service, but their use requires extreme care lest the bowel should be perforated.

The whole hand has been introduced into the rectum for the purpose of exploring it and examining the contents of the pelvis generally. This should be done with the patient under an anæsthetic, and can only be safely effected by a Surgeon who has not too large a hand; eight inches round in measurement is said to be the largest hand that can be safely introduced. When this mode of examination is possible, much information can be acquired, if the relative anatomical position of the different parts contained in the pelvis is kept in mind. It must however be borne in mind that the operation is one of considerable severity and must not lightly be undertaken. Before carrying it out, the entire large intestine must be thoroughly washed out by injecting several quarts of water. The hand should be introduced slowly, the fingers being held in the form of a cone. The knuckles should not be passed higher than seven inches up the bowel.

Finally it is to be noted that in many rectal disorders, *e.g.*, internal fistula and stricture, a carefully noted history, given by an intelligent patient, is invaluable.

CHAPTER XVII.

EXAMINATON OF THE BLADDER.

Examination of the bladder may be conducted by palpation and percussion, or by means of the sound or the cystoscope. Digital examination is sometimes made through a perineal or suprapubic incision.

Palpation above the pubes will reveal the existence of distension of the organ in cases of retention of urine. In some diseases of the bladder pain is felt on applying pressure over this region. The presence of vesical calculi may sometimes be detected by palpation. Bi-manual examination with one or two fingers in the rectum and the other hand over the hypogastric region may sometimes be practised with advantage.

Percussion.—The amount of distension of the bladder may be ascertained by percussion.

Examination by means of the sound.—The Surgeon is not fully satisfied of the existence of a stone in the bladder till he feels it, and hears the characteristic 'click' caused by striking it with a sound. This instrument is not unlike an ordinary metal catheter in shape. It is generally made of well-polished steel, and the size required varies with the age of the patient. For adults a sound corresponding to a number seven catheter is most frequently used, and for children one corresponding to a number three. The lower end of the sound is generally curved at an angle of 120° with the shaft; the extremity is called the 'beak.'

Simple as the procedure of sounding the bladder is, it must be done with the greatest gentleness and care. It is necessary that two or three ounces of urine should be in the bladder at the time of examination, or the bladder may preferably be emptied and two ounces of warm boracic lotion be injected; more fluid than this increases the difficulty of examination. The rectum should beforehand be cleared out by an enema. As regards anæsthesia, it is seldom necessary in the case of adults, unless the patient be nervous or unless the urethra be exceptionally sensitive. In children, however, an anæsthetic should always be given. The patient should lie on his back with a low pillow under his head and a somewhat higher one under his buttocks. The Surgeon stands on the right side of the patient, and the sound warmed by friction and lubricated with carbolized oil is gently introduced and allowed to glide along the urethra chiefly by its own weight. As the sound is entering the bladder it is rotated from side to side on its long axis to search the neck of the bladder, this being the most usual site for the stone to lie in. Failing to discover anything, the sides, the roof and the fundus are explored. Then the handle is depressed, the beak pointed downwards and then drawn forwards to the entrance of the bladder. This latter manœuvre often detects a stone which may lie concealed behind an enlarged prostate. Sir H. Thompson's sound with its short beak is admirably adapted for this particular manœuvre. The instrument should be very slowly moved during these manœuvres, otherwise currents may be produced and a small stone missed. To aid the examination in some cases, it is necessary to introduce a finger into the rectum, or pressure may have to be applied over the pubes.

The stone having been detected, an estimate of its size, nature, position, and whether more than one exists, is to be arrived at. The size may be approximately determined by passing the sound over the stone or by introducing a lithotrite and catching it; there is, however, an element of error in this latter plan, as the stone may be seized on its short axis. The nature of the calculus can often be detected by striking it with the sound. The extremes of tone lie between the oxalate of lime which emits a clear ringing note and the phosphatic of which the tone is dull. As a rule the loudness of the note elicited is in direct proportion to the size of the stone. By moving the sound over the surface, the tuberculated exterior of the oxalate of lime or the smooth surface of the uric acid calculus may be detected.

The situation should then be noted, and whether the stone is fixed or otherwise. The number present can best be estimated by passing a lithotrite and catching a stone firmly and then using it and the lithotrite as a sound in searching for others.

Several plans for intensifying the note produced with the sound have been used, the best known being L'Estrange's sounding-board.

After an examination for stone, the patient should be confined to his bed for at least a day, as fever or retention of urine may possibly follow.

The difficulties and sources of fallacy are not a few. The most common is the failure to find a stone when it is present —for instance, (*a*) a small stone may be caught up in the folds of the bladder; (*b*) it may be so small that it may recede before the sound when the bladder contains urine (in such cases charge of posture may cause the stone to fall on the end of the instrument); (*c*) a stone may lodge behind an enlarged prostate; (*d*) the sound may not have entered the bladder, a dilated prostatic urethra having been mistaken for it; (*e*) a stone may escape detection if it is encysted. Under the same heading may be included sacculation of the bladder.

Stones have at times been supposed to be present when they were non-existent. This is not of so common occurrence as the converse before mentioned. The sacral promontory and ischial spines have been mistaken for calculus. Phosphatic deposits on the mucous membrane of the bladder, enlargement and coating with phosphates of the middle prostatic lobe, vesical tumours similary coated, contraction of the bladder on the sound, noises produced by striking the patient's trouser buttons or the Surgeon's sleeve links, have, it is said, led to errors in diagnosis.

A strictured urethra may prevent a diagnosis, and it is not to be forgotten that, in this country, stricture sometimes leads to formation of stone, due to the patient passing straws, portions of which break off and form a nucleus for phosphatic calculi.

In women, the diagnosis of vesical calculus is seldom attended with difficulty. The sound should be short and nearly straight. Vaginal examination combined with the sound is the best method. Bi-manual examination, one hand being over the pubes and two fingers in the vagina, will not alone detect the stone, but enable one to form a fairly accurate idea of the size. In the case of children or unmarried females the finger should be passed into the rectum.

Examination by means of the cystoscope.—As the use of this instrument requires much skill and practice, a description of the method of using it would be out of place in this chapter.

CHAPTER XVIII.

CLINICAL EXAMINATION OF GYNÆCOLOGICAL CASES AND OBSERVATIONS ON THE MANAGEMENT OF LABOUR AND THE PUERPERAL STATE.

Position and size of the uterus and appendages.—The healthy unimpregnated *uterus* is suspended midway in the 'pelvic cavity.' The 'fundus' lies slightly below the plane of the pelvic brim and a line drawn from the upper border of the symphysis pubis to the lumbo-sacral articulation would indicate about the upper limit of the organ. A line drawn from the lower border of the symphysis pubis to the junction between the fourth and fifth sacral vertebræ would pass through the lower part of the cervix. In its general direction the uterus lies with its long axis in the axis of the brim of the pelvis. It is held in position chiefly by its relations to contiguous viscera, particularly the bladder and rectum, by the support afforded by the surrounding connective tissue and by the vaginal columns, by folds of peritoneum around (the so-called ligaments) and by the two round ligaments which are continuations of the uterine muscular tissue. The peritoneum is in close contact with the muscular wall at the upper part, covers the anterior surface of the body and the whole of the posterior surface of the organ except the infravaginal cervix. The organ is capable of a considerable degree of movement, and its position varies with the state of the adjacent viscera, the posture of the individual and with certain acts such as defœcation, straining, coughing, &c. The upper part or fundus is more moveable than the cervix. The cavity of the healthy unimpregnated uterus measures two and a half inches of which about half belongs to the cervix. The cavityof the body is more or less triangular and flattened from before to behind. The cavity of the cervix is spindleshaped, extending from the os uteri externum to the os uteri internum. The greatest breadth is at the fundus, the greatest thickness eleven or twelve lines. The average weight nine or ten drachms. From each angle of the fundus spring the *Fallopian tubes* which are contained in the central portion of the lateral folds of peritoneum called the broad ligaments. The '*ovaries*' lie in the posterior fold of the broad ligament on either side of the uterus and separated from it by a short space. They can be rarely felt unless displaced or enlarged.

The inferior portion of the cervix is implanted into and projects into the vagina for about four lines. The *vagina* is a curved canal from three to four inches in length with its sides in apposition to one another. Posteriorly its upper fourth is in direct relation with the peritoneum.

METHODS OF EXAMINATION AND MEANS OF DIAGNOSIS IN CASES OF UTERINE DISEASE.

Abdominal palpation, simple abdominal palpation, the patient lying in the dorsal posture, affords much information, especially in cases of inflammation, tumours, &c.

Inspection is required occasionally, but is by no means invariably necessary or desirable.

Simple vaginal touch is practised with the patient lying in the dorsal posture or on her left side.

Bi-manual examination or conjoined manipulation.—This is of all the most useful form of examination and affords more information than any other method. It combines simple vaginal touch with palpation. It is best practised with the patient lying on her back on a flat couch with a light covering over her, everything tight in the shape of stays being removed or loosened. The left thigh should be slightly flexed on the abdomen. The index or index and middle finger of the left hand should be lubricated with oil or simple ointment and passed under the left thigh to the vaginal outlet, at the same time the right hand can be placed flat on the abdomen without. The examining finger can then examine, if required, the external generative organs and can then be passed into the vagina. Here it will note the existence of pain, spasm, &c.; the capacity, existence of tenderness and temperature of the vagina, the condition of the walls, relaxed or otherwise, the presence of any discharge and its character. From the examination of the vagina, the finger can be passed on to the cervix uteri. Here note—position of cervix in the pelvis, size, general direction, the existence of tenderness, consistency of tissue, size and shape of external orifice, existence of any roughness or erosion, presence of discharge and its character. With the assistance of the external hand the position and size of the whole organ, its consistency, the presence of tenderness, its mobility, &c., can be accurately gauged in almost all cases by careful manipulation. From a general examination of the uterus, the examining finger can leave the cervix and be passed in succession, behind, on each side and in front, and any thickening around the organ, the presence of any tumour and its relation to the uterus can be made out, the condition of the ovaries can also be investigated.

For the special examination of the ovaries and tubes it is advisable to have the patient placed at the lower end of the examining couch or table, with the thighs well flexed. The examiner should stand at the end of the couch and pass the examining hand between the thighs, making downward pressure with the other hand on the lower part of the abdomen. The condition of each tube and ovary can then be accurately determined. For this examination an anæsthetic is sometimes desirable, especially when there is much spasm of the abdominal muscles, or much pain and tenderness exist.

Rectal touch.—This is best practised with the patient in the left lateral position. It is a useful method of examination in virgins when a pelvic examination is necessary or for the better investigation of the ovaries.

Speculum.—This instrument is useful rather as a means of treatment and should not be depended on to too great an extent as a means of diagnosis. In using the speculum, the patient should lie on the left side with the hips at the edge of the couch or table and the thighs bent on the abdomen the right being thrown over the left. The most useful speculum for either diagnosis or treatment is Sim's univalve speculum or perineal retractor. Ferguson's tubular speculum is useful for exposing the cervix and Cusco's bivalve speculum is useful for all purposes. The speculum may be also used when the patient is lying on the back with the buttocks drawn to the edge of the couch and the thighs flexed on the abdomen. In either case the examination can be made more complete by drawing down the cervix with a suitable vulsellum forceps. In using the speculum, note pain or spasm on introduction, appearance of vaginal mucous membrane and of any discharge, appearance of cervix and external os uteri with presence and character of any discharge, &c.

Sound.—The sound or uterine probe is generally used as a means of diagnosis to determine the position and size of the uterus. The most useful sound is made of flexible metal and marked by notches at the inches for about eight inches. The flexibility of the instrument allows it being bent into any shape. It is best used in conjunction with the speculum. The cervix being exposed it may be fixed by a fine vulsellum forceps or tenaculum. The sound being then held lightly in the right hand, the tip being oiled, can be passed into the cervix and on, if necessary, to the fundus. With this instrument we ascertain the shape of the uterus, the position of the organ, the shape and capacity of the cavity, existence of tenderness, &c. By graduated metallic sounds, we can also ascertain the size of the external orifice and the dimensions of the cervical canal. Caution must invariably be exercised in the use of the uterine sound.

Dilatation of cervix uteri by tents or dilators.—This may be necessary when it is required to investigate carefully the cavity of the uterus, either as a means of diagnosis or a method of treatment.

It must be always borne in mind that the most minute cleanliness and thorough aseptic conditions must be maintained in all examinations and manipulations of these organs.

POINTS TO BE NOTED IN RECORDING CASES OF DISEASE.

Date, name, age, married? Number of children, number of miscarriages, date of last confinement, date of last miscarriage, age at first menstruation, date of last menstruation, how long ill, supposed cause, symptoms, present condition and general health.

Menstruation, regularity, duration, amount, pain.
Leucorrhœa, character, amount.
Pain, locality, character.
Other symptoms.
Physical examination.
1, Vaginal touch; 2, speculum; 3, sound.
Diagnosis.
Treatment.

POINTS TO BE ESPECIALLY ATTENDED TO IN CASES OF LYING-IN WOMEN.

Attend at once to any summons to a woman in labour. Take antiseptic solutions or tabloids, a stethoscope, ligature thread, blunt-pointed scissors, male elastic catheter number eight or nine, Higginson's syringe, blunt-pointed bistoury, double-curved long forceps, suture needle with wire, silk, silk gut or chromic gut, chloroform, laudanum, ergot, ether, minim measure. Two sublimate gauze or iodoform gauze bandages, 8 yards each, muslin bag containing 2 oz. absorbent cotton wool.

Conduct in lying-in room should be calm, cheerful and re-assuring. Determine if woman is really in labour or suffering from false pains. Enquire into general health, nature of previous labours if any, state of bowels and bladder. Examine abdomen for fœtal heart and movements *Vaginal examination*,* note the degree of warmth and moisture, size and distensibility condition of rectum, capacity and form of pelvis: state of cervix, thick or thin, soft or rigid, degree of dilatation, presence or absence of membrane; presentation and position of child, character of pains. In first stage avoid frequent examination and allow woman to sit or move about. In second stage examine more frequently and note progress of labour; keep woman lying down in any position until head is on perineum when the left lateral should be assumed; at birth of child, follow uterus down, and, after separating child, place mother on back and support the uterus. Conduct third or placental stage with great care. Half an hour after placenta is cast, apply binder if uterus is firm; if hæmorrhage has occurred, the uterus should be manually supported for two hours. Do not leave the house till one hour after the placenta has been cast, and ascertain that the uterus is well contracted and that there is no hæmorrhage. If any tear of perineum occurs repair it at once or within twelve hours.

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* The best antiseptics for use in the lying-in room are—

Solution of corrosive sublimate, 1 in 50.
Solution of corrosive sublimate in glycerine.
Corrosive sublimate tabloids.
Do. do. 10-grain powders coloured with 1 grain carmine.
One powder to be dissolved in a quart of hot water.
Carbolic acid solution, 1 in 20.
Solution of permanganate of potash 4 grains to water one ounce.

Before making any examination of a woman in labour, the external organs of generation should be very carefully washed with soap and water, and if the bowels have not been freely moved an enema of soap and water should be given to empty the lower bowel. The genitals should then be carefully swabbed over with a solution of corrosive sublimate 1 in 1,000.

The hands of the examiner should be well scrubbed with a nail brush with soap and water and the nails especially carefully cleaned. The hands should then be dried with a clean towel and afterwards immersed for a full minute, or while the person counts 60 slowly in a solution of corrosive sublimate 1 in 1,000, or solution of carbolic acid 1 in 40, or solution of permanganate of potash. After this the hands need not be dried, but the examining fingers should be anointed with an antiseptic ointment or corrosive sublimate glycerine ½ grain to 1 oz. glycerine.

In cases in which a woman has been long in labour, or there is premature escape of the liquor amnii, or when there is any evidence of putridity of contents of uterus, the passages should be well douched with an antiseptic solution, both before and after the delivery.

In the Puerperal State.—Visit woman within twelve hours after delivery. Enquire regarding sleep, passage of urine, condition of external genitals, discharge, after pains, food. Note general appearance, pulse, temperature, breathing, condition of uterus, bladder, binder.

During Puerperal State.—Note the character of lochia, occurrence of fever, want of sleep, quick pulse, distension of abdomen, tenderness of abdomen or uterus, size of uterus and progress of involution, distension of breasts. Keep a native recumbent for a week and a European for ten days or a fortnight. Exertion to be made only gradually and with caution, and only after lochial discharges have ceased or become quite pale in colour.

With regard to the Infant.—Note at birth formation and general development. Subsequently enquire into sleep, navel, excretions, clothing, food.

Points to be observed in recording cases of labour.—Name, age, number of pregnancy, nature of labour (natural, difficult, preternatural, or complex).

Presentation.
Position.
Sex of child.
Duration of labour. { first stage.
second stage.
third stage. }

Rule for calculating the probable date of confinement of a pregnant woman.—Find the day on which the woman last ceased to menstruate. The next day, *i.e.*, the first day after the last menstruation is the day from which the calculation should ordinarily commence. That day nine months forward will be 275 days, unless February is included, in which case it will be 273 days. To this day add three days in the former case and five days in the latter. This 278th day will be in the middle of the week in which the confinement is most likely to take place and is the day on which in most cases the pregnancy terminates.

CHAPTER XIX.

ON THE EXAMINATION OF CHILDREN.

This subject requires some remarks, in the first place the mortality amongst children is very high, their diseases often run a very rapid course, especially in this country, and lastly, it is only by the exercise of close observation, great patience, kindness, gentleness, and a peculiar tact, that a man ever becomes a good child's doctor. First, learn from the mother or guardian its hereditary tendency, its previous illnesses, and the history of the present illness.

Sir William Jenner's directions to his class in reference to the mode of examining children, are somewhat as follows: After stating that the diseases of children are not as ill-defined as some persons imagine, he proceeds to say, that if called to a child and it be asleep, the practitioner should not wake it, but whilst it is asleep, he should note its attitude and position, whether it lies covered or uncovered, if with its legs drawn up or not, if it lies on its back or its side, the two latter points indicating the degree of strength and the seat of pain. The colour of the cheeks (heightened in pneumonia and enteric) should be noticed, or local sweating especially about the head, as is seen in rickets. The expression of the face, which is calm in health, should be noted, moans, startings, twitchings, shrieks, clutching of the hands, are to be observed as they are suggestive of cerebral mischief, twitching of the mouth often occurs in gastric irritation. The observer should then note if the nares act markedly, as in acute chest affections, whether the eye be completely closed as in health, or half closed as in cerebral disease, if the respirations be quickened or not (they are from thirty to forty in a minute in health).

If the child is awake on your entrance, take care that the sight of a stranger does not frighten it. Do not let it see that you are observing it for some time until it has got accustomed to your presence, the first thing you have to do is to gain its confidence which you must retain all through, or you will never be able successfully to examine or treat it. No one ever gains the confidence of children who does not love them. If the child is awake the pulse is readily excited, it should, therefore, be felt in sleep, the hand being warmed for the purpose. The pulse of a healthy child under two years may beat from 90 to 140 in a minute, or more, after three years it does not exceed 100. A very rapid pulse is little guide to disease in children, a slow pulse is of more consequence. The state of the fontanelles should be noticed especially in reference to their size, tension, and pulsation, when the child is awake. When a child wakes, its expression, the state of the surface, and position may be observed, a smile is inconsistent with serious illness. In abdominal affections, the mouth is pinched up, the legs drawn up; the expression is one of suffering in colic, of langour in enteric fever, there is a wasted look in chronic diarrhœa, a "shrivelled" face in muco-enteritis, an aged appearance, an earthy hue of the skin with fissured corners of the mouth and condylomata in congenital syphilis. The hand should always be passed over the head, which is enlarged in hydrocephalus, rickets, and hypertrophy of the brain, and the fontanelles much opened. Then the child should be stripped if necessary, when rickety deformities can be seen, enlarged glands and eruptions be detected, the arms and feet examined for syphilitic eruptions, and the buttocks for itch. The shape of the chest is peculiar in young children, there is a constriction at the upper border of the liver on the right side, and the upper border of the stomach on the left side. In some diseases, of the pleura, in rickets, and when there is spine disease, the chest is often altered in shape. The apex of the heart beats rather more to the left than in the adult, marked signs of lung disease are found at the back, and friction sounds between the scapulæ may be due to disease of the bronchial glands. The belly is big in children, this is accounted for by the short pelvis, the large liver, the thin and unresisting abdominal walls, and the fact that the diaphragm is less arched than in the adult. The spleen, kidneys and liver are easily felt. The child should now be made to put its arm around the mother's neck, if it be frightened it clings all the closer, and renders the back tense, which can be auscultated either *mediately* or *immediately* and then percussed. The chest is not very resonant since the walls are flaccid and do not vibrate. A supposed big head is often a trouble to mothers, if the fontanelles are closod and the child be about two years of age, or if they be just open and no cerebral symptoms be present, there is no need for anxiety. In practising percussion, care must be taken not to strike too smartly, the variations in resonance being more readily appreciated by a gentle stroke, it is almost unnecessary to say that mediate percussion must be employed, that is to say, the blow must fall on the finger not on the chest wall. Valuable information may often be gained by listening to the chest of a child when it is crying, since the forced inspiratory and expiratory movements cause the air to enter and leave the lungs rapidly, and to expand them more fully so as to bring out various ronchi and other sounds which might otherwise not be produced if the breathing was tranquil. The child's cry is in this case equivalent in its action to the taking of a "deep breath" in an adult. The respiration is slightly puerile in a child. Lastly, the temperature, then the state of the tongue, the condition of the gums, of the tonsils, and of the number of the teeth, remain to be ascertained, it being generally better to examine these last as they are usually the most grievous part of the examination to the child.

Children cut their teeth as follows:—*Milk teeth.* At seven months, the two lower incisors; at one year old, the first molars appear; at one and a half year, the canines; at two, the last molars. Usually the lower central incisor appears first, then the upper central incisor, and after then the lower lateral incisors. *Permanent teeth.* During the seventh year, the *anterior* molars appear; during the eighth, the central incisor; during the ninth, the lateral incisors; during the tenth, the anterior bi-cuspids; during the eleventh, the posterior bi-cuspids; during the twelfth, the canines; from the twelfth to the fourteenth, the second molars; and from the eighteenth to the twenty-fifth, the third molars or *wisdom teeth.*

Healthy children grow at the following rate per annum. Slow growing, two inches; average, two and a half; fast, three. A child that grows only two inches a year will be a short adult. Weight should increase regularly with height, and growth should be regular not by fits and starts. A child thirty-six inches high should weigh thirty-six pounds, at forty-eight inches should weigh sixty-eight pounds, at sixty inches ninety pounds. The fontanelles should be closed at the end of the second year. Attention should be especially directed to the state of the nursery, the surroundings of the child, its food and clothing. Dr. West says, minute rules for your examination of children from three years old and upwards are not needed, but patience the most untiring, and good temper the most unruffled, are indispensable.

CHAPTER XX.

THE EXAMINATION OF THE INSANE.

Mental diseases may be classified under the following three primary heads :—

(1) Mental depression.
(2) Mental exaltation.
(3) Mental weakness.

(1) **Mental depression**—Includes all forms of melancholia simple, hypochondriacal, delusional, obstinate, organic and suicidal.

(2) **Mental exaltation**—Includes the various types of mania such as simple, acute chronic, delusional, homicidal and ephemeral.

(3) **Mental weakness**—Includes dementia, imbecility, idiocy and all conditions in which the brain development is deficient.

To get a clear conception of the subject of 'Insanity' (or a deviation from the natural state of the mind), it is essential for us first to make ourselves thoroughly conversant with the mind as it is in the natural state, by noting the changes in the two great functions of the brain, namely, those of (1) sensation and (2) motion which take place at the different stages of life between infancy and old age. We are at once struck by the very complex mechanism of the brain and nervous system, and it is not until we have mastered and made ourselves familiar with these natural or physiologial changes that we can recognize when abnormal or pathological changes ensue.

Now from a clinical point of view we must pay particular attention to the following points in examining an insane or supposed insane :—

(1) His temperament, his habits, what sort of man he was and what delusions he has, if any, what changes have taken place and how he now differs from his former self, whether he is suspicious or suicidal and whether his power of self-control is affected.

(2) In interviewing an insane it is of the highest importance for you to take an interest in all he says, to sympathize

with him and to gather all the information you can, especially by leading up to his weak points or delusions.

At the same time by careful observation you can detect any strangeness in his manner or appearance, any excitability or depression, the state of his memory, his feelings towards his relatives; the conformity of his head and the state of his bodily health will at once be apparent to you, any abnormality in his articulation of words or peculiarity in his handwriting.

You will often find that the very expression of a man will be sufficient to tell you whether he is sane or not, and if insane you will sometimes be able to say from what form of insanity he is suffering.

In many cases, again, you will find that your greatest difficulty will be in getting your patient to speak at all, he will remain stolidly silent to all your questions, or perhaps his answers will be incoherent and unintelligible, and in such cases as these you will have to trust to your own powers of observation and to the information you can elicit from friends, and if you are still unable to formulate an opinion, you must keep your case under observation for a time, until further symptoms develop to enable you to make a correct diagnosis.

(3) It is necessary that you should always have before you the fact that possibly you are not dealing with an insane at all, but that he is suffering from some other disease that has been mistaken for insanity, such as the 'effects of some narcotic poisons,' the 'effects of alcoholism or other intoxicants,' some traumatic injury to the head, sun-stroke and such like conditions, and it is only by a careful method of exclusion that you are enabled to arrive at a sound and correct diagnosis. It is not at all infrequent for people to be certified as insanes and transferred to asylums who on examination after admission are found to be suffering from some minor or trivial complaint and are not insane at all. You cannot be too careful in your examination of all supposed mental diseases.

(4) Then again, it is part of your duty to remember that although you are making a clinical examination of a supposed mental case, the fact, that possibly some bodily ailment or disease may be the real causation of the mental aberration, must be ever before you, and it is therefore important that in every such case a systematic and thorough examination

should be made of all the bodily organs, including the pulse, temperature and the condition of the urine and bowels before you express an opinion. You will sometimes meet with cases exhibiting many marked signs of mental aberration resulting from insomnia, the causation of which you will find to be nothing more or less than a derangement of the digestive powers, and easily cured by a little attention to diet and the state of the intestinal secretions.

(5) Once more you must also take into consideration that in one sense your opinion regarding an insane is much more onerous than in dealing with ordinary cases, and for this reason that it has a medico-legal as well as a purely medical aspect; you have the power of depriving your patient of his freedom and the control of his own affairs by getting him confined in an asylum; this side of the question is a most important' one and requires you to weigh all the 'pros,' and 'cons' most carefully before giving a decided opinion, and in any case of doubt rather to keep your patient under observation for further development of symptoms than to draw too hasty a conclusion.

Having made your examination thoroughly there still remain several questions which you should put to yourself before giving your opinion. Is the patient insane at all? Is it safe to leave him to the care of his friends, even if a reliable attendant can be obtained, or should he be sent to an asylum at once? What form of insanity is he suffering from? What special lesion of the brain is likely to be the cause of his insanity? What treatment is likely to be of use? Is he likely to recover, if so, how soon is his ultimate recovery likely to take place? Is there any immediate danger to be apprehended such as suicide or sudden death?

All these questions will come up before your mind in dealing with cases of mental disease, and in every detail you must be cautious and guarded in your opinion. You will find that sometimes the most hopeless will recover, while those you are inclined to venture a hopeful opinion on, grow rapidly worse.

The documents required in this country before a patient can be admitted into an asylum (in accordance with Lunacy Act XXXVI of 1858) are as follows :—

Form A.

I, the undersigned ,
hereby certify that I, on the day of at
, personally examined ,
and that the said, , is a lunatic
and a proper person to be taken charge of, and detained under care and treatment, and that I have formed this opinion on the following grounds, namely :—

I.—Facts indicating insanity observed by myself.

II.—Other facts (if any) indicating insanity communicated to me by others.

189 . } Surgeon.

Form B.

Order for the Reception of a Private Patient (*see Section VII of Act XXXVI of 1858*).

I, the undersigned, hereby request you to receive ——— ——————————— a lunatic (or an idiot, or a person of unsound mind), as a patient into your asylum. Sub-joined is a statement respecting the said ———————

(Signed) name———————————————
Occupation (if any)———————————————
Place of abode———————————————
Degree of relationship (if any), or other circumstances of connexion with the patient———————————————
———————————————————

Dated this———day———————of 189 .

To
THE SUPERINTENDENT, LUNATIC ASYLUM AT .

STATEMENT.

[*If any of the particulars in this Statement be not known, the fact to be so stated.*]

Name of the patient, with Christian name at length______

Sex and age______

Married, single, or widowed ______

Condition of life, and previous occupation (if any)______

The religious persuasion as far as known______

Previous place of abode ______

Whether first attack______

Age (if known) on first attack______

When and where previously under care and treatment______

Duration of existing attack______

Supposed cause ______

Whether subject to epilepsy______

Whether suicidal______

Whether dangerous to others______

Whether found lunatic by inquisition or enquiry under order of Court, and date of Commission or order for inquisition or enquiry ______

Whether any member of patient's family has been or is affected with insanity ______

(Signed) Name______

(*Where the person signing the statement is not the person who signs the order, the following particulars concerning the person signing the statement are to be added, namely*):—

Occupation (if any)______

Place of abode______

Degree or relationship (if any), or other circumstances of connexion with the patient ______

Medical History Sheet for Lunatics.

Order—dated 13th September 1894, *No.* 2224, *Judicial.*

This Medical History Sheet will be prepared by the Superintendent of the Asylum in cases where the release of a person from a Lunatic Asylum is in question and by the Medical Officer who prepared the certificate of insanity in Form A in cases where such a certificate is given. In the cases of persons acquitted by Criminal Courts on the ground of insanity at the time of the commission of the crimes charged, the Medical History Sheet will be prepared by the aquitting Court in communication, if necessary, with a Medical Officer. In all cases the information required to fill in headings 28 and 29 will generally be obtained from the District Magistrate or the Commissioner of Police, Madras.

1. Whether Civil or Criminal lunatic.
2. If Criminal, the offence with which charged.
3. By what authority confined.
4. Date of admission.
5. Place of birth and last abode.
6. Name in full and caste or race.
7. Sex and present age.
8. Whether married and number of children.
9. Religion.
10. Previous occupation.
11. Temperament.
12. State of bodily health.
13. Degree of education.
14. Natural affection, whether perverted or not.
15. Habits and disposition.
16. Type of insanity.

MEDICAL HISTORY SHEET FOR LUNATICS—*cont.*

17. Probable cause of insanity.
18. Is there any record of previous attacks? If so, give dates.
19. Duration of present attack; has it been continuous? give dates.
20. Is there any evidence that insanity is hereditary?
21. Has lunatic been addicted to use of intoxicants?
22. Have aggressive or suicidal symptoms been shown at any time?
23. If so, when, and of what kind?
24. If sane at present, how long since last manifestation of insanity?
25. Nature of medical treatment.
26. Is lunatic capable of (*a*) taking care of himself, (*b*) earning a livelihood?
27. How has lunatic been employed while in confinement?
28. Is release on security recommended?
29. If so, what amount should be demanded, and what are the names, social position, character and relationship to lunatic of the sureties?

STATION }
DATE 189 . } Surgeon.

(*a*) **For a private patient—**
- (1) Two medical certificates (Form A).
- (2) Admission order (Form B).
- (3) An indemnity bond.

(*b*) **For a pauper non-paying patient—**
- (1) Medical certificate (Form A), one copy.
- (2) Medical History Sheet, one copy.
- (3) Admission order from a judicial officer.

The official classification of 'Mental Diseases' is given in the 'Nomenclature of Diseases' sub-section III of the 'Diseases of the Nervous System.'

CHAPTER XXI.

CLINICAL OBSERVATIONS ON CASES OF CONTAGIOUS DISEASES.

Contagion may be defined as the "process by which a determinate disease is communicatod from person to person by means of a particulate or sensible material which, existing in the body of the sick person or other animal, is transmitted by direct contact, or by an intermediate carrier, to one not sick of the disease, in whom it produces the same disease with like power of propagation." A distinction was formerly made between 'infection' and 'contagion.' Such a distinction is no longer recognised.

The *contagium*, so far as known, is always of the naturo of a living organism, which may be of a vegetable or of an animal nature. It may be transmitted from one individual to another by *inoculation*, *i.e.*, by absorption through an abrasion, wound or ulcer, as in vaccinia, hydrophobia, leprosy and syphilis; by *direct contact*, especially of mucous membranes, as in gonorrhœa and purulent ophthalmia, or of skin, as in scabies; by the medium of the *surrounding atmosphere*, thus gaining access into tho body by the lungs, alimentary canal or skin, as seen in tuberculosis and typhus fever; by means of *food and drink*, *e.g.*, water and milk, as in cholera and enteric fever; or by *fomites*, including articles of clothing, bedding, hair, books, &c., or conveyed by the attendants on the sick person, or by furniture, or by remaining on the floors and walls of the sick room, or by being carried by flies or other insects, or by domestic animals, as cats and dogs.

The effects of a *contagium* or *virus* may be entirely local, as in scabies; while in other diseases, as syphilis and small-pox, the local are followed by general or constitutional effects. In some diseases the lymphatic glands become specifically affected. Once a contagium has gained access into the system it multiplies in the body, probably at the expense of the constituents of the blood and tissues. When universally diffused through the system it finds a habitat in those structures which afford the most suitable *nidus* for its growth and there undergoes further development. At first there are no outward manifestations of the action of the contagium upon the system. The period of time during which it remains thus dormant is called the period of *incubation.* Different diseases have different incubation periods, and the period for any one disease may vary within considerable limits (*vide* table). The first outward manifestation of the operation of such a contagium on the system is a general disturbance of the functions, as seen in the pyrexia of the exanthemata. This is called the *period of invasion.* The local manifestations or specific lesions of the disease that are limited to one organ, or to several parts at the same time, constitute its 'anatomical characters,' *e.g.*, the various eruptions of the specific fevers. Such local lesions are indicated by corresponding symptoms which often aggravate the general constitutional disturbance. After a certain time has elapsed the symptoms subside—the *period of decline* or, if there has been fever, *defervescence* follows, the contagium ceases to multiply and is finally excreted from the system, leaving temporary or permanent structural changes behind.

The specific infectious diseases may be thus classified :—

I. **Acute Specific Fevers.**—The initial phenomena are slight. The phenomena of infectiveness are marked; an eruption is one of the most characteristic. The secondary local phenomena are variable. The following are included in this class: Typhoid fever,* typhus fever, variola, varicella, scarlet fever, measles, relapsing fever, plague and cholera.

II. **Specific Inflammations.**—Initial phenomena indefinite. General phenomena (infectiveness) variable, but no eruption. Specific affinity of poison for one particular structure. Whooping cough, mumps, diphtheria, dysentery, erysipelas, tetanus, hydrophobia, pneumonia, belong to this class.

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* The eruption of typhoid fever is often absent in this country. In any case a dark skin renders the observation of a slight rash very difficult or impossible.

III. **Contagious Suppurations.**—Initial phenomena marked (suppuration); generalisation not marked unless the virus enters the blood; secondary local phenomena decisive, gonorrhœa is a type of the first; pyæmia, in which the blood is infected, of the second.

IV. **Infective Granulomata.**—Distinct initial phenomena. Phenomena of generalisation not marked, or like specific fevers. Secondary local phenomena prominent. Examples: Tuberculosis, syphilis, leprosy and glanders.

V. **Miasmatic Diseases.**—No initial phenomena. Malarial fevers.

VI. **Vegetable Parasitic Diseases.**[*]

Of the diseases included in the above classification only some are infectious in the ordinary sense, *i.e.*, liable to be communicated to other persons who are sick or in attendance upon the sick. Under conditions of defective ventilation or overcrowding and general insanitariness, certain other diseases may be so communicated, owing to the increased contagiousness or virulence acquired as a result of such favouring conditions. Special wards should be set apart for the reception of doubtful cases—called *isolation wards*. At the General Hospital, Madras, infectious diseases of all kinds were, till lately, freely admitted; a most objectionable and dangerous practice which was permitted simply because the Municipality of Madras had hitherto failed to supply adequate accommodation elsewhere. Small-pox, chicken-pox, measles, mumps, erysipelas and cholera are the diseases most commonly admitted to the infectious diseases wards at that hospital. Certain skin diseases, such as itch and pemphigus, are also isolated as far as possible. Syphilis, gonorrhœa, typhoid fever, tetanus, &c., are treated in the general wards. Diphtheria is very rare, scarlet and yellow fever are unknown. In dealing with contagious diseases of all kinds the student should take every precaution as to cleanliness, etc., both for his own sake and for the sake of the patients in the general wards.

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[*] "The virus, as the living cause is named, in many instances, produces certain changes at the point of entrance—*initial phenomena*. It is then conveyed by the lymphatics or blood vessels to near by organs in the related lymph or blood stream, or transmitted to the whole body. When the whole body is affected an eruption is sometimes produced (eruptive fever), or the blood is changed in quality (diphtheria), or many tissues are affected simultaneously, or the nervous system notably disturbed. The above are the *phenomena of general distribution* of the virus, or of *infectiveness*. The virus or poison thus distributed may be the living organism, as in tuberculosis or anthrax, or it may be a poison generated by the organism, a toxin or ptomaine, as in diphtheria.

"Phenomena of secondary local distribution are due to local changes in organs affected secondarily. The poison has a special affinity for certain organs, as in whooping cough, parotitis, pneumonia or leprosy.

"In some instances the local phenomena are so marked as to give the disease a corresponding distinctive feature, as in the granulomata" (Musser). The above classification, taken from the same author, slightly altered, can only be regarded as provisional; *e.g.*, typhoid fever might be relegated to class II. The student will find information regarding many of the diseases mentioned under this list in various other chapters of the *Clinical Manual*.

Bearing in mind the facts already stated, the student should note the following points in the clinical investigation of all cases of contagious diseases:—

History with reference to the source of the contagion:—Where was the disease contracted? Has the disease recently occurred in the house or neighbourhood? Had the patient come in contact with any person who recently suffered from the disease? Had the family bought any clothing, bedding, or funiture, new or second hand; if latter, from what source and when? Has there been any visitor from where the disease exists; if so, who and when, and where was the residence of such person? Has there been any travelling in any public conveyances; if so, when? Where and by whom are the clothes washed? *

Note the residence, race, occupation and habits of the patient, state of health before the attack and whether he suffered before from any epidemic or contagious disease: what was the immediate exciting cause: note the prodromata, the mode and the precise date and hour of the first appearance of symptoms, the date of the appearance of secondary diseases if any. Observe the condition of the patient at the time of admission with reference to his appearance, decubitus, intelligence and expression. If the condition of the patient will permit, make a complete systematic examination: give the diet and treatment in detail. Note the daily progress, the effect of treatment, the temperature both morning and evening and, if there are paroxysms, take the temperature at their height (acme): note the state of the

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* The writer is well aware, of course, of the supreme difficulty in obtaining such information in this country.

circulatory, respiratory, digestive and nervous systems: examine also the condition of the secretory and excretory organs, especially noting the urine as to the amount of urea, total solids and quantity excreted. Examine the state of the blood from time to time. Carefully note all complications, the date of their appearance and their cause: note the progress of emaciation, the day of the disease, the mode of termination of the attack and the character of convalescence. If there is a relapse, note the cause and the course followed by the relapse. Note the mode of death in fatal cases, as from syncope, asthenia, asphyxia or coma. When a *post-mortem* examination is made, describe the anatomical appearances of the tissues and of the internal organs.

In recording the contagious diseases attended with fever, or with fever and an eruption, the following points in addition to those enumerated above should be noted :—look for marks of any former eruption as of small-pox, vaccinia,* constitutional syphilis, leprosy, &c. Note the precise date and hour of the first appearance of the fever, the character of the paroxysms, their duration, and any peculiar co-existing symptoms. Note the exact date and hour of the appearance of the eruption, its seat, amount, mode of spreading, its characters from the time of its appearance to its decline, its duration, its varieties, and the mode of its disappearance, whether suddenly or by desquamation. Note the mode of the termination of the fever, whether by 'crisis,' 'lysis,' 'pseudo-crisis' or 'remittent defervescence and critical or post-critical evacuations.'

Diagnosis of acute specific diseases.—An accurate knowledge of their different characters is necessary, and carelessness or undue haste should be avoided in forming an opinion. It is sometimes necessary to watch the progress of events and to observe the phenomena which present themselves before a diagnosis can be made. The primary requisites to form a correct diagnosis in each case are that the observer should understand the *etiology* and course of each acute specific disease, the different infectiveness of each, the modes by which the contagium may be conveyed, the conditions which affect its propagation, the period of incubation, and the liability of the patient to the effects of the contagium. The *clinical history* of each of these diseases differs in (*a*) *the mode of invasion*, (*b*) *the characteristic symptoms*, (*c*) *the skin eruptions*, (*d*) *the degree of pyrexia and march of the temperature*, (*e*) *the duration*, (*f*) *the mode of elimination*, (*g*) *the mortality*, (*h*) *the varieties*, (*i*) *the complications*, *and* (*j*) *the sequelæ.*

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* Note the number and characters of any vaccination marks in cases of small-pox.

The following statement shows the maximum periods of incubation and the isolation period necessary in the case of those (*a*) who have suffered from any of the diseases mentioned, or (*b*) who have been exposed to the chance of infection * :—

The Isolation and Incubation Periods of Contagious Diseases.

Disease.	Isolation required after patient has suffered from the diseases named in column 1.	Isolation required after healthy person has been exposed to the disease. Also incubation period.
Asiatic Cholera	Seven days from complete cessation of diarrhœa.	10 days.
Chicken-pox ...	When every scab has fallen off ...	18 days.
Diphtheria ...	After not less than three weeks' convalescence is completed, there being no longer any form of sore-throat or any kind of discharge from the throat, eyes, nose, ears, &c., and no albuminuria.	12 days.
Enteric or Typhoid fever.	One week after temperature has become normal, and all bowel symptoms have disappeared.	23 days.
German Measles (Rötheln) & Epidemic Roseola.	Two to three weeks from the date of the appearance of the rash, the exact time depending on the nature of the attack.	18 days.
Influenza ...	Three days after the temperature has become normal, and all catarrhal discharges have ceased.	5 days.
Measles ...	Not less than three weeks from the date of the rash and all desquamation and cough have ceased.	16 days.

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* Compiled by the Association of Medical Officers of Schools (in England).

The Isolation and Incubation Periods of Contagious Diseases--cont.

Disease.	Isolation required after patient has suffered from the diseases named in column 1.	Isolation required after healthy person has been exposed to the disease. Also incubation period.
Mumps ...	Three to four weeks from the commencement, allowing one clear week from the subsidence of all swelling.	25 days.
Ringworm ...	When a medical examination of the whole scalp (any suspicious spots being scrutinised with a lens) reveals no broken-off stumpy hairs.*	
Scarlet fever.	Not less than six weeks from the date of the rash, if desquamation has completely ceased, and there is no appearance of sore-throat, and no discharge from the ears, nose, &c.	14 days.
Small-pox ...	When every scab has fallen off ...	18 days.
Typhus ...	Ten days after the temperature has become normal throughout the twenty-four hours.	14 days.
Whooping cough.	One week after the complete cessation of the characteristic spasmodic cough.	21 days.

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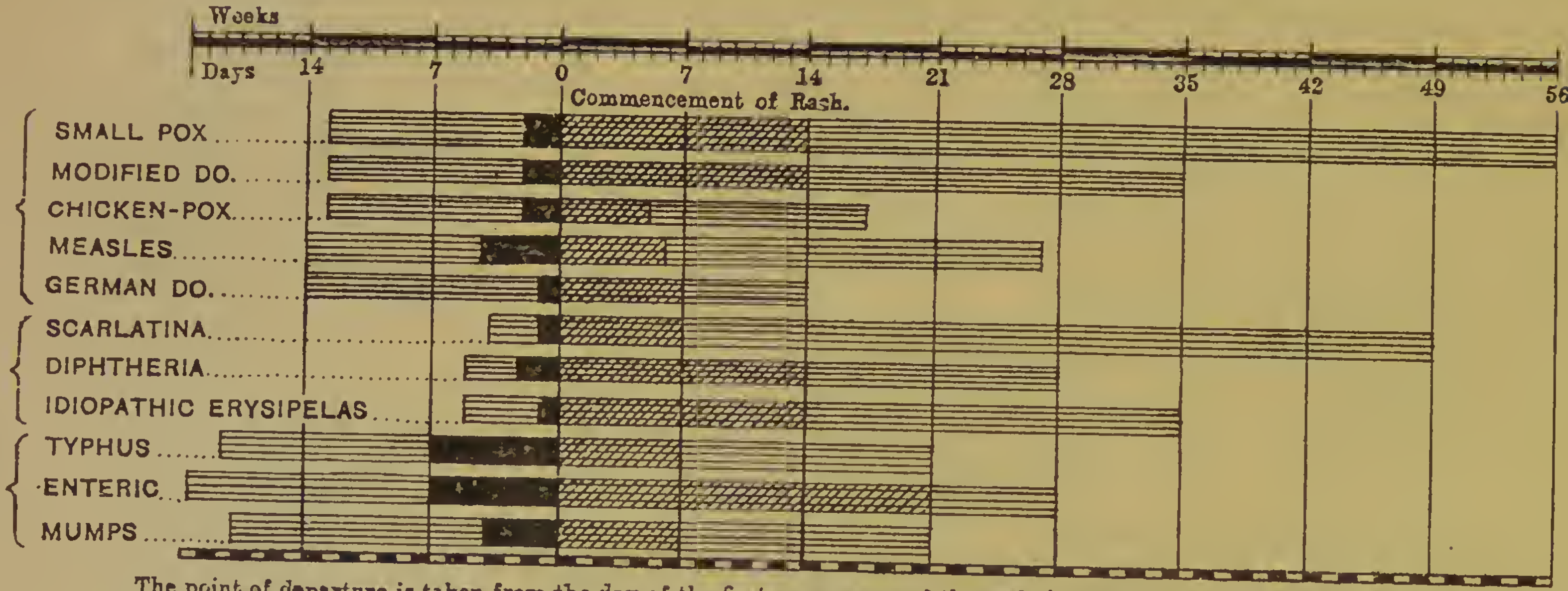
* [Ringworm ('dhobi's itch') may be considered cured when the affected patches of skin have resumed their normal appearance.]

FIG 4

NORMAL PERIODS OF LATENCY, PREMONITORY FEVER, DURATION OF FEVER, AND LENGTH OF INFECTIVENESS OF SOME OF THE CONTAGIOUS DISORDERS.



The point of departure is taken from the day of the first appearance of the rash (in Diphtheria, of the false membrane, in Mumps, of the swelling of the glands) as being the most definite and characteristic phenomenon, and from which point the calculation is made, to the *left* in estimating the probable time of inception, to the *right* for freedom from infection.

1 ▤ = Period of absolute latency.
2 ■ = Period of fever before the rash.
3 ▨ = Period of fever subsequent to the first appearance of the rash.
4 ▤ = Period of infectiveness subsequent to the fever.

1 + 2 = Period of incubation.
2 + 3 = Period of fever.
2 + 3 + 4 = Period of possible infectiveness.

After M. A. Adams, F.R.C.S.

CHAPTER XXII.

THE EXAMINATION OF THE URINE.

The following notes are taken principally from Dr. Wickham Legg's *Guide to the Examination of the Urine*:—

Urine varies in colour from pale yellow to clear amber yellow, or reddish yellow, but it may be as colourless as water, or dark brown like porter; its colour is due to *urochrome* according to Thudicum. A smoky tint is diagnostic of the presence of blood, a brownish green suggests the presence of the colouring matter of the bile. Certain drugs affect the colour of the urine. Thus rhubarb and senna impart a deep brownish yellow colour, due to chrysophanic acid. Hæmatoxylum gives a red tinge. Santonin may make the urine bright-yellow or greenish. Carbolic acid and creasote, even when absorbed after local application, are liable to colour the urine dark greenish brown or black.

A pale urine is often seen in health; also in disease in anæmia, diabetes, nervous disorders as hysteria, and convalescence after fever or acute diseases. A pale urine contains little colouring matter and but a small proportion of solid constituents, always excepting, however, the urine of diabetes mellitus. A high coloured urine occurs in health, after food and after severe exercise; and in disease, in fevers, and most of the acute diseases in which considerable metamorphosis of the tissues takes place. It contains much colouring matter and urea in proportion to the water.

Quantity.—This varies in different individuals, and in the same individual at different times from the influence of season, food, exercise, &c. From twenty-five to forty ounces in hot weather and from thirty to fifty in cold weather may be considered the average; but considerable variations in quantity are consistent with perfect health. The solid matter contained in either case generally ranges between seven hundred and nine hundred grains in weight.

Translucency.—In health, the urine deposits, after remaining at rest for a short time, a slight cloud of mucus derived from the bladder and urinary passages, but in all other respects healthy urine is perfectly clear. On cooling, however, it sometimes becomes turbid from the presence of urates. Phosphates are deposited in alkaline urine as a rule, but occasionally in that which is neutral or faintly acid.

Should the urine be turbid when first voided, it is a mark of disease, and pus is the most frequent cause of this appearance.

Odour.—When the urine loses its natural smell and becomes fœtid and ammoniacal, the change is due to the decomposition of the urea into carbonate of ammonia, and the formation of sulphur compounds; in cases of cystitis and paraplegia the alteration begins very quickly after, if not before, it is voided. Various foods and drugs, as asparagus, cubebs, sandalwood and turpentine, give a characteristic smell to the urine.

Consistence.—The urine is a limpid fluid flowing freely from one vessel to another. Pus, in ammoniacal urine, assumes the characters of a ropy, viscid material which can be drawn out into strings. Chylous urine has a whitish, opaque and milky aspect. The froth on normal urine readily disappears, but if the froth be permanent, the presence of albumen, or of the constituents of the bile, may be suspected.

Specific gravity varies in health between 1,015 and 1,025; it should be tested by the urinometer. The specific gravity of a portion of the whole quantity passed during the previous twenty-four hours should be tested; that of a small quantity taken by chance is of little use.

Sugar in the urine is the most common cause of a high specific gravity; if it is not present, an excess of urea will be the probable cause.

A low specific gravity, below 1,010, occurs after fluid has been taken in quantity. A low specific gravity is also frequently noticed in chronic Bright's disease; immediately after a paroxysm of hysteria; in anæmic states; in diuresis from any cause, such as mental emotion, or exposure to cold. It is often seen in natives when they are leading an inactive life.

A high specific gravity, with a pale colour, and a low specific gravity with a deep tint, are equally signs of disease.

Reaction.—Urine is almost always secreted acid, although it may become alkaline within a very short time of being passed. In the majority of cases in which the urine is said to be alkaline, as in paraplegia and cystitis, the alkalinity is really due to decomposition after being passed. If the urine then be found to be alkaline, a fresh specimen should be tested immediately after it has been voided. In cases of retention the urine sometimes becomes alkaline in the bladder, and in health can be made alkaline by the administration of drugs, such as the carbonates, acetates, citrates, or tartrates of the alkalies.

When the alkalinity of the urine is due to ammonia, the brown colour of the turmeric disappears when the paper is exposed for some time to the air, or gently heated; but the change from yellow to brown is permanent if the alkalinity is owing to either potash or soda.

Urine is rarely neutral in reaction.

The cause of the acid reaction of the urine is the presence of the acid phosphate of soda, and, according to some observers, of free lactic and hippuric acid. Very shortly after being voided the acidity increases, and this lasts in health in a cold climate for days, free uric acid being often thrown down. Sooner or later, however, the alkaline fermentation sets in, and the urine becomes ammoniacal and fœtid from the conversion of urea into carbonate of ammonia, and the formation of sulphide of ammonium, while the phosphates and urate of ammonia are deposited as a white sediment.

Clinical import.—The acidity of the urine is decreased during digestion and increased by fasting or perspiration. A very acid, high coloured urine is associated with the so-called 'uric acid diathesis.' This condition favours the occurrence of calculus and gravel.

Alkalinity of the urine, if no alkalies have been administered, is due to the decomposition of urea into carbonate of ammonia; it is present in some diseases of the spinal cord, and especially in chronic affections of the bladder and urinary organs, as a few drops of urine which have undergone the alkaline fermentation will rapidly set up the same change in fresh urine. When the alkalinity of the urine is due to fixed alkali, either potash or soda, it may arise from catarrh of the urinary passages, the injection of alkaline salts, or some alteration in the metamorphosis of the tissue. About this last condition little is known with certainty; it is always best treated by meat diet and iron.

The following apparatus and re-agents are required for testing urine:—

Cylindrical urine glasses, each containing about six fluid ounces; urinometer, the stem of which is graduated from 1,000 to 1,060; blue and red litmus, and turmeric paper; test-tubes; a spirit lamp; nitric acid, acetic acid, liquor potassæ or liquor sodæ; solution of sulphate of copper ten grains to the fluid ounce, or Fehling's test solution for sugar; a glass funnel; filtering paper and a microscope.

SCHEME FOR THE EXAMINATION OF THE URINE.

The following plan should always be followed in examining urine and notes made accordingly:—

1*st.*—Note the odour and colour of the urine, its appearance as to translucency, consistence and the presence of any sediment.

2*nd.*—Measure the quantity passed in the previous twenty-four hours.

3*rd.*—Ascertain the specific gravity of a specimen of the whole quantity; then ascertain the specific gravity of a portion of that passed on first rising in the morning. A few drops should first be passed into a separate vessel, the remainder will be a good sample of the urine as passed from the bladder free from any urethral discharge.

4*th.*—Examine the reaction by means of litmus paper as to whether it is acid, neutral, or alkaline.

5*th.*—Test the urine for albumen and note the relative quantity if it is present. If albuminous, examine the deposit from a conical glass for renal casts, epithelium, pus, or blood corpuscles.

6*th.*—Test the urine for sugar.

7*th.*—If there be no albumen or sugar present and no sediment, the urine need not be further examined unless some special indication exists.

8*th.*—If any sediment be observed, it must be examined with the microscope. The following are the more common deposits:—

Pink or red deposit which dissolves on heating the test-tube—urate of soda.

White crystalline deposit soluble in acetic acid—phosphates.

Hummocky white sharply defined cloud insoluble in acetic acid, but readily soluble in mineral acids—oxalate of lime.

White amorphous flocculent deposit rendered ropy, viscid and gelatinous by the addition of about half its quantity of liquor potassæ—pus; if it is not rendered ropy but becomes fluid and limpid—mucus.

Brownish and red crystalline deposit—uric acid. Red amorphous deposit—blood.

The following is a rough method for calculating the amount of solids in the urine: the solids in a fluid ounce of urine represents nearly as many grains as the specific gravity exceeds 1,000. This, however, is only an approximation. When taking the specific gravity the temperature of the urine should be that of the surrounding atmosphere, otherwise great errors may creep in. It must be remembered that the limit of error in the above calculation is greater in diseased than in healthy urine :—

Table showing the amount of Urinary Constituents excreted by a Grown-up Man in the twenty-four hours—(PARKES).

Quantity	40 to 50	fluid ounces.
Total solids	800 to 1,000	grains.
Urea	350 to 600	,,
Uric acid	5 to 15	,,
Chlorine	50 to 150	,,
Phosphoric acid	30 to 60	,,
Sulphuric acid	20 to 60	,,

Specific gravity from 1,012 to 1,025—average 1,021.

Specific gravity varies, nearly in inverse ratio to quantity, according to season, period of the day, kind of food, &c. Urina sanguinis (morning) is 2° to 3° higher than after food, or at night.

Table of the quantity of Solids in a fluid ounce of Urine according to its Specific Gravity (*from* DR. CHRISTISON).

Specific gravity.	Weight of fluid ounce in grains.	Solids in fluid ounce in grains.	Specific gravity.	Weight of fluid ounce in grains.	Solids in fluid ounce in grains.
1,010	441·8	10·283	1,025	448·4	26·119
1,011	442·3	11·336	1,026	448·8	27·188
1,012	442·7	12·377	1,027	449·3	28·265
1,013	443·1	13·421	1,028	449·7	29·338
1,014	443 6	14·470	1,029	450·1	30·413
1,015	444·0	15·517	1,030	450·6	31·496
1,016	444·5	16·570	1,031	451·0	32·575
1,017	444·9	17·622	1,032	451·5	33·663
1,018	445·3	18·671	1,033	451·9	35·746
1,019	445·8	19·735	1,034	452·3	36·831
1,020	446·2	20·792	1,035	452·8	37·925
1,021	446·6	21·882	1,036	453·2	38·014
1,022	447·1	22·918	1,037	453·6	39·104
1,023	447·5	23·981	1,038	454·1	40·206
1,024	448·0	25·051	1,039	454·5	41·300

This table will be found useful in practice, although it is only approximative.

THE CONSTITUENTS OF THE URINE.

Urea.—To ascertain the presence of urea, the urine should be first tested for albumen, which, if present, should be removed by acidulation with two or three drops of acetic acid, boiling and filtering. Take two or three ounces of urine and evaporate over a water-bath until the fluid has the consistence of syrup. After the fluid has cooled, nitric acid, as free as possible from nitrous acid, is added drop by drop so long as a precipitate is formed. An excess of nitric acid is desirable. Some of these crystals of nitrate of urea, removed with a glass rod and placed under the miscroscope, show flat rhombic or hexagonal plates closely united to one another.

The quantity of urea eliminated is said to be increased in most acute diseases. In chronic diseases, especially those accompanied by a cachexia, the amount of urea is below the average. Its amount is increased by a high meat diet.

Uric acid is a less oxidised stage of urea. Murexid *test* for uric acid. Place a small quantity of the urine on a porcelain dish; add a little nitric acid; evaporate over a spirit-lamp until a yellowish-red residue is left; touch this, when cold, with a glass rod dipped in solution of caustic ammonia. A characteristic bright, violet colour is immediately brought out.

Chlorides.—Test.—Take a fluid drachm of urine in a test-tube, add a drop of nitric acid, and then a few drops of a solution of nitrate of silver; if a trace of chloride be present, a cloudiness only will be given, but if in any quantity, a white precipitate is thrown down which is soluble in caustic ammonia, and reprecipitated by the addition of nitric acid in excess. The nitric acid is added at first to prevent the precipitation of the phosphates with the chlorides.

A rough comparative idea of the quantity of chlorides present may be made from day to day by always taking the same quantity of urine, acidulating it in a test-tube with nitric acid, and adding a solution of nitrate of silver until no further precipitate is formed. The test-tube must then be set aside for twenty-four hours, and a note taken of the proportion of the chloride of silver deposit.

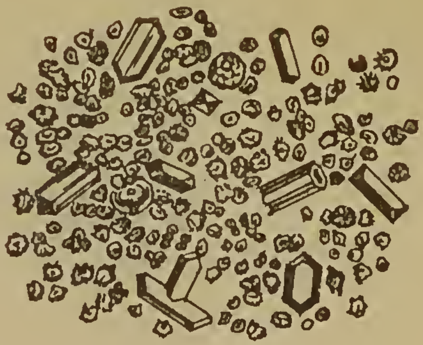
Clinical import.—During acute pneumonia, acute rheumatism, and most other pyrexial diseases, the chlorides diminish in quantity, or even disappear from the urine. Their re-appearance in daily increasing quantity is a sign of the diminution of the intensity of the disease. The amount of chlorides apparently depends upon the digestive powers of the patient even in chronic diseases.

Phosphates and sulphates.—These are not of so much importance. The former are found in greater quantities in diseases of the nervous centres and of the bones; after great mental application; and in acute febrile diseases. They are said to diminish or disappear after the acme of the paroxysm of ague. The quantity of sulphates is increased by a full animal diet.

Urinary sediments.—About four or five ounces of the urine to be examined should be set aside for a few hours in a tall conical or cylindrical glass and allowed to deposit. When the sediment has collected, the supernatant liquid should be poured off. The sediments have been divided into the *organized*, such as pus, blood, mucus, epithelium, renal casts, and spermatozoa; and *unorganized*, as uric acid, urates, oxalate of lime, phosphates, tyrosin, leucin, and cystine.

Organized.—(*a*) *Pus*, vide Fig. 5.—If the urine has been long passed the pus corpuscles undergo changes and cannot be recognised. Urine containing pus readily becomes alkaline. Pus occurs in the urine in cases of gonorrhœa or gleet; pyelitis from any cause; cystitis; any abscess bursting into any part of the urinary tract; and in leucorrhœa in women.

FIG. 5

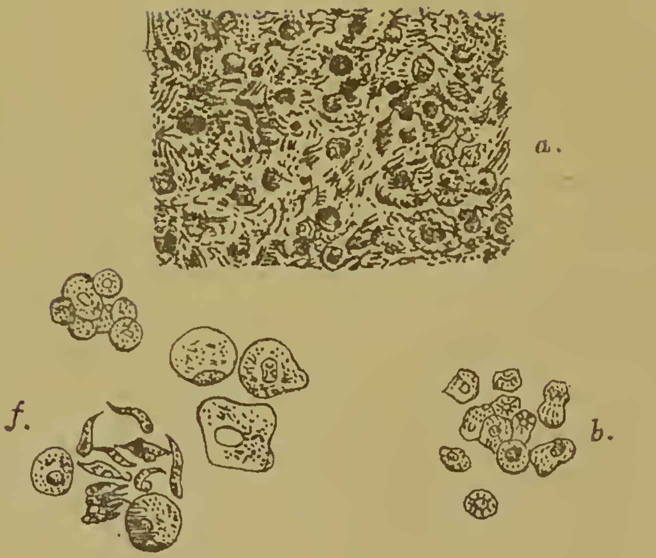


Blood, pus and crystals of triple phosphate from the urine.—'BEALE.'

(*b*) *Blood*, vide Fig. 5.—It may come from any part of the urinary or renal tract; if from the kidneys it is diffused through the urine and gives it a peculiar smoky appearance. The quantity of albumen is often great enough to solidify the urine on heating. Blood is found in the urine in cases of acute Bright's disease, congestion, cancer, tubercle or injury of the kidney; when there is a calculus in the pelvis of the kidney, or in the ureter; in parasitic diseases, such as the *Bilharzia hæmatobia ;* in cases of calculus in the bladder; cancerous or villous growths, congestion or ulceration of the mucous membrane; in injuries to the mucous membrane of the urethra, or in inflammation of it as in gonorrhœa; in women it is sometimes due to uterine discharges or menstruation. In some cases hæmaturia depends on the *filaria sanguinis hominis.* It may also be noticed in abnormal conditions of the blood, particularly in connection with purpura and scurvy; but also in malignant fevers and cholera.

If the amount of blood is large it probably comes from the pelvis of the kidney, from the ureter, or the bladder; it is commonly said that if the blood be completely mixed with the urine, the hæmorrhage is from the kidneys; if the urine first passed be clear, and at the end of micturition become bloody or even pure blood be passed, the hæmorrhage is from the bladder or prostate; while, if the first portion of the urine be bloody, and the last drops clear, the hæmorrhage is from the urethra. These rules, however, are not infallible.

(*c*) *Mucus and epithelium.*—These are found in every specimen of urine. From the urethra and bladder a roundish or oval cell is seen; from the vagina, squamous epithelium like that of the mouth; from the mucous membrane of the pelvis of the kidney and ureter, under irritation, caudate, spindle-shaped, and irregular cells are produced like those once considered diagnostic of cancer.



FIG, 6.

Fig. 6—*a*, Mucus. In the lower part right-hand side several cells of bladder epithelium are represented, b. Epithelium from pelvis of kidney, *c*, from ureter, *d*, from urethra, *e*, from vagina, *f*, from different parts of bladder.—'Beale.'

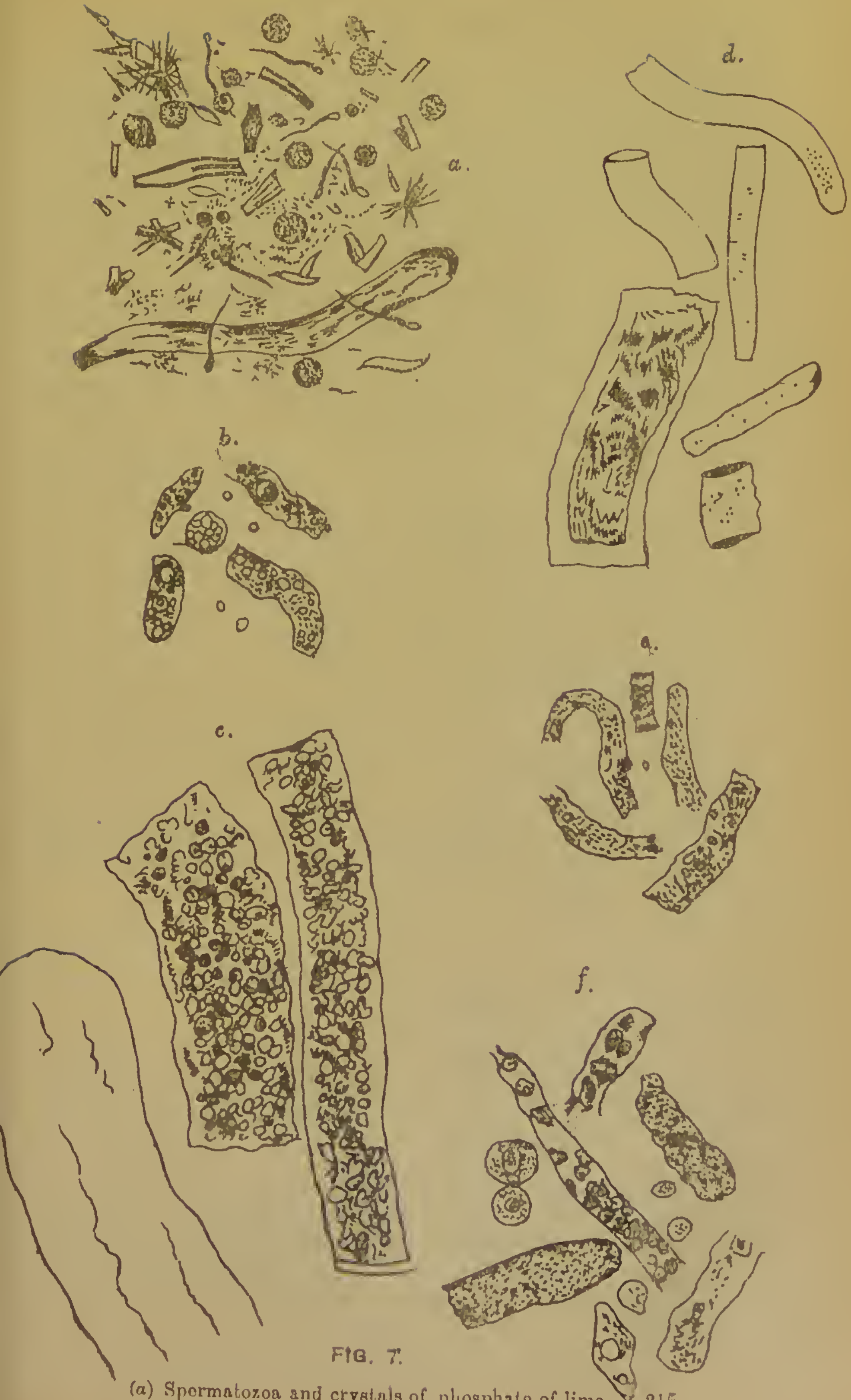


FIG. 7.

(*a*) Spermatozoa and crystals of phosphate of lime, × 215.
(*b*), (*c*), (*d*), (*e*), (*f*) Renal casts.

(*d*) *Renal Casts.*—If urine contains albumen, renal casts should be looked for. Fig. 7 (*b*) Casts containing oil globules and free fat cells, × 215; (*c*) Large casts, some containing many cells, others consisting of a perfectly transparent wax-like material, × 215; (*d*) Waxy casts, large and small, × 215; (*e*) Small granular casts, × 215; (*f*) Epithelial casts, some containing cells and some granular matter, × 215.—'BEALE.'

These casts consist of cells and exudations which have accumulated in the uriniferous tubes and have been carried down in the urine. The exuded material takes the shape of the tube, and being washed out appears as a 'cast' or mould of the tube. The composition of the cast varies; it may entangle any substances present in the uriniferous tubes, such as epithelial cells, blood discs, crystals, fat cells, &c., or it may be a perfectly transparent mould, supposing it to be simply coagulated serosity. The casts will vary in size according to the size of the uriniferous tubes they come from. Supposing the lining of the tubes to be increased in thickness the 'casts' will be *small*; supposing the tubes to be deprived of their epithelial lining the 'casts' will be *large*. As the changes in the uriniferous tubes in different parts of the kidney cannot be the same in extent, the size and nature of the casts will vary somewhat. Therefore we must be guided by the general characters of the casts present in any particular case.

'*Epithelial casts*' are small, about $\frac{1}{700}$ of an inch in diameter; they are moulds of the uriniferous tubes due to a certain amount of exudation, in which the shed epithelial cells are entangled. They are seen in the early stages of acute nephritis.

'*Granular casts.*'—In these the epithelium is broken down into debris. It is characteristic of the chronic stages of desquamative nephritis.

'*Waxy or hyaline casts.*'—These are large, $\frac{1}{500}$ of an inch, or small $\frac{1}{1000}$ of an inch. They are transparent, hyaloid and glistening. They may be slightly granular. They indicate, when small, that the epithelial lining is still present in the kidney tubes, and when large, that it is lost. But all waxy casts indicate serious disease of the secretory structure of the kidney. The name *oily casts* is given to fibrinous casts enclosing oil globules. Fatty changes in the kidney may also be indicated by the presence of epithelial cells loaded with fat globules, which is always a serious condition.

(*e*) *Spermatozoa* (*vide* Fig. 7, *a*.) are occasionally found in the urine of men, even in health.

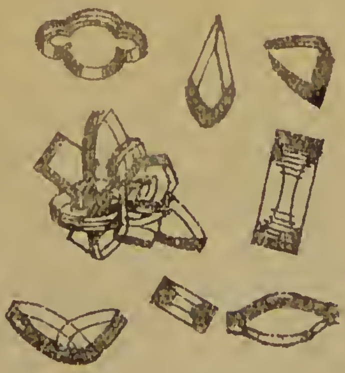
Fungi and Bacteria are found in most urines after the ammoniacal decomposition has begun, or is about to begin. Bacteria occur as *vibriones*, *monas crepusculum*, *microzyma*; fungi as the *penicilium glaucum* (mildew), *torula cerevisiæ* (yeast). *Sarcinæ* are sometimes seen.

Kiesteine is a whitish pellicle formed on the surface of the urine of pregnant women when it is allowed to remain at rest for a few days. It appears to consist chiefly of the mildew fungus, globules of fat, and crystals of phosphates. It is not an absolute sign of pregnancy, as it is sometimes found in the urine of men and is not always present in the urine of pregnant women.

Chylous urine —This is an affection occasionally seen in this country. The urine passed is turbid and quickly coagulates after being passed. The disease is generally intermittent and is considered to be due to the presence of the *filaria sanguinis hominis*, vide Plate III, which should always be looked for both in the urine and in the blood. The albuminoid substance which is found in such urine is of totally different nature from the albumen of the serum according to Eggel.

Unorganized sediments. (*a*) *Uric Acid*, see Fig. 8.—Urine which deposits this substance is always very acid. Generally the uric acid is mixed with urates. It is somewhat like powdered Cayenne pepper or reddish brown brick dust. Its crystalline forms are very numerous.

FIG. 8.



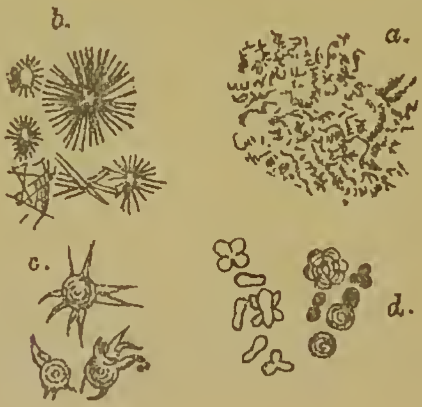
Uric acid crystals.—'ROBERTS.'

Clinical import.—It may be that a deposit is taking place in the pelvis of the kidney or in the bladder and a calculus is forming.

(*b*) *Urates.*—The most common and least important of all, they are formed of uric acid combined with soda, potash, ammonia, and lime. They are found in most febrile states, or when there has been great perspiration and diminution of the relative quantity of water in the urine. They are not uncommon even in health.

Heat dissolves the precipitate very speedily and completely, and *liquor potassæ* produces the same effect.

FIG. 9.

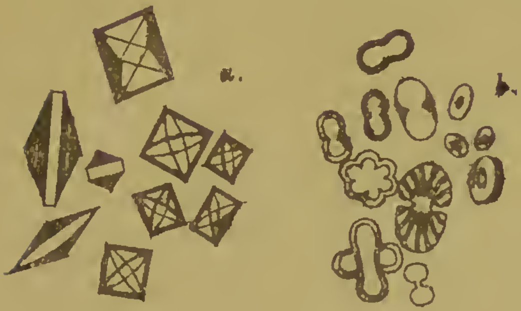


Urates.—'ROBERTS.'

(*c*) *Oxalate of lime.*—This is the most common unorganised deposit after urates. It is often seen in the urine of patients convalescent from acute diseases. It is said by some writers to be present whenever there is diminished oxidation. This sediment is said to be associated with a dyspeptic and hypochondriacal condition, sometimes termed the 'oxalic acid diathesis.' The mulberry calculus is formed of oxalate of lime.

Oxalate of lime is not dissolved by *heat*, *acetic acid*, or *liquor potassæ*; but is speedily soluble in *mineral acids*.

FIG. 10.

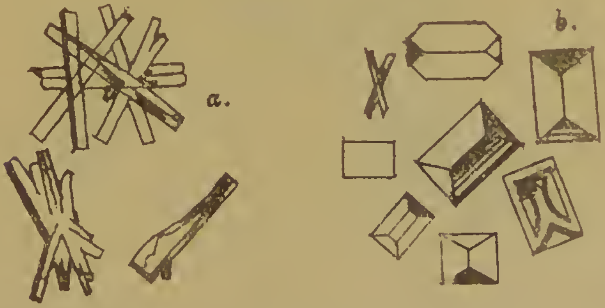


Oxalate of lime crystals.—'ROBERTS.'

(*d*) *Phosphates.*—They are deposited in alkaline urine as a rule. Sometimes they are deposited in feebly acid urine.

Phosphates are *precipitated by boiling*. A drop of *nitric acid dissolves* them at once.

FIG. 11.



Stellar-phosphates and triple phosphates.—'ROBERTS.'

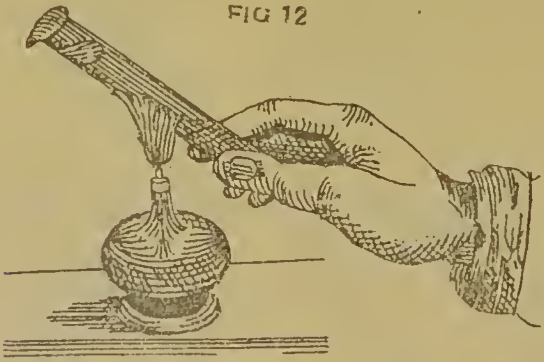
(*e*) *Leucine and tyrosin.*—These are rare deposits in the urine. Under the microscope leucine appears in dark globular forms which have been compared to masses of fat cells. Tyrosin, however, crystallizes in beautiful bundles of delicate needles, sometimes arranged in a stellate form. These bodies have been detected in the urine in cases of acute yellow atrophy of the liver, small-pox, enteric fever, and acute tuberculosis.

(*f*) *Cystine*—occurs in regular colourless hexagonal plates, united by their flatsurface, and overlapping one another. It is sometimes found as a deposit in urine; its clinical import is unknown.

Foreign bodies.—The following bodies are constantly found mixed with the deposits of urine, and the student should be able to recognize them all under the microscope:—fragments of human hair, wood, wool, cotton fibres, portions of feathers, starch, and free oil globules.

Tests for albumen.—Fill a test-tube about two-thirds full of urine and boil the upper layer of the fluid over the flame, of a spirit lamp, the lower end of the tube being held between the thumb and the forefinger. Compare the boiled stratum with the cool layer in the lower part by holding the test tube against the light. If there is any cloudiness allow a drop or two of dilute nitric acid to flow gently down the side of the tube into the urine, the cloud will be permanent if due to albumen, but disappears immediately if due to the earthy phosphates.

FIG 12



Mode of holding the test-tube when boiling urine after Wickham Legg.

Cautions.—Do not use too much nitric acid; if the urine is turbid from the presence of urates, clear it by the application of slight heat; if the reaction of the urine is either neutral or alkaline, the albumen will not be precipitated by heat until it is acidulated by the addition of a few drops of dilute acetic acid; if the urine is very turbid, it may be necessary to filter it.

Rough estimation of albumen.—Half fill a test-tube and boil the contents; treat with nitric acid as above and allow to stand for twenty-four hours; record the quantity precipitated as a trace, one-sixth, one-fourth, and so on as the case may be. If urates are present, the urine must be filtered before boiling, as on cooling they will be deposited and lead to error.

The chief conditions with which albuminuria may be associated are—

1. *Admixture of albuminous fluids*, namely, blood or some of its elements; pus from any source; or semen. 2. *Venous congestion of the kidneys*, particularly that due to cardiac diseases, to chronic or acute lung affections, or to pressure upon the renal veins or the inferior vena cava. 3. *Acute febrile and inflammatory diseases.* 4. Certain affections attended with *an unhealthy state of the general system or blood*, such as purpura, scurvy, &c. 5. *Acute and chronic renal diseases.* 6. *Certain poisons*, such as mercury, arsenic, &c. 7. Some forms of *hepatic or digestive disorder.* 8. *Disordered innervation*, affecting the renal vessels—*neurotic albuminuria.*

Functional albuminuria, according to Dr. Grainger Stewart, includes all cases where exercise or exertion, diet, exposure to cold, mental emotion and obscure psychic influences account for the symptom.

DIABETIC CHART.

Name *Age* *Occupation*
Race and Caste *Date of admission*

Date.	Quantity of urine passed in ounces.	Reaction.	Specific gravity.	Estimated quantity of sugar in grains.	Diet.	Treatment.	Weight of patient in pounds once a week.	REMARKS.

Urine of specific gravity 1,020 is calculated to hold 402 grains of solids to each pint; for every degree above 1,020 add 18½ grains.

Roberts has found that, after fermentation, "the number of degrees of 'density lost' indicates as many grains of sugar per fluid ounce."

Tests for sugar.—If the specific gravity is above 1,030, sugar should be looked for—

Moore's test is a rough but useful one. Equal parts of urine and liquor potassæ or liquor sodæ are poured into a test-tube and the upper layer is heated to boiling. The heated portion becomes brown red, dark brown, or black according to the quantity present.

Cautions.—If the urine is high coloured, or contains an excess of phosphates, or is albuminous, the colour becomes darker on boiling with caustic alkalies. If the urine is albuminous, it must first be boiled and the coagulated albumen removed by filtration. Care must be taken that the liquor potassæ is free from lead, which it takes up from white glass bottles if it is kept in them; if the urine contains sulphur, a black sulphide of lead is formed on boiling.

Copper tests, Trommer's, about a drachm of the suspected urine is poured into a test-tube, and liquor potassæ or liquor sodæ added in about the same quantity. A weak solution of sulphate of copper (10 grains to the ounce) is then dropped into the mixture; the precipitate which first forms is redissolved on shaking the test-tube, the copper solution should be carefully added, shaking the test-tube after each drop has fallen into the mixture as long as the precipitate is easily redissolved, after this the solution will have acquired a blue or green colour, but should be quite clear and free from any precipitate; the contents of the test-tube must be next heated to boiling, when, if sugar be present, an orange red precipitate is first thrown down, which after some time becomes reddish brown. This precipitate consists of the sub-oxide of copper.

Cautions.—The liquor potassæ should be from 20 to 30 per cent. of strength, not the weak pharmaceutical liquor. Too much copper must not be added; always use a slight excess of potash; never operate save with a clear solution.

Fehling's test.—Keep the following solutions in a cool dark place in stoppered bottles covered with blue paper. No. 1, Dissolve 665½ grains of crystallized potassio-tartrate of soda in five fluid ounces of a solution of caustic potash sp. gr. 1·12. No. 2, Dissolve 133½ grains of sulphate of copper in ten fluid drachms of distilled water. When wanted for use, add a fluid drachm of the sulphate of copper solution (No. 2) to half a fluid ounce of the alkaline solution (No. 1).

Take about two drachms of the mixed solution and boil in a test-tube. If no precipitate forms, it is all right, but if a red precipitate is thrown down, it is useless. If the solution is found to be good, boil it again, and while it is boiling, add the urine drop by drop and watch the effect. A few drops of urine which contains much sugar will at once give a precipitate of yellow or red suboxide; but if no precipitate occur, the urine should still be added to the fluid drop by drop, any deposit being carefully looked for, until a quantity nearly equal to that of the solution employed has been added. If no precipitate form after setting the test-tube aside for an hour the urine may be considered free from sugar.

Cautions.—Always boil the test solution to prove it; the quantity of urine must never exceed that of the solution; do not continue boiling the urine at a high temperature.

Fermentation test.—A few grains of yeast are put into a test-tube, which must then be filled with urine and inverted in a shallow dish containing a little of the urine and set aside in a warm place. If sugar is present in the urine, the formation of carbonic acid gas will drive the urine out of the test-tube.

According to Brücke, healthy urine contains about ·01 per cent. of sugar.

Clinical import.—If any of the foregoing tests announce the presence of sugar in considerable quantity, as often as the urine is examined (for when sugar is found the urine should be examined daily for some time), *diabetes mellitus* may be inferred to exist. But should the presence of sugar be variable, and its amount small, the fact is not of any known great diagnostic or therapeutic importance. Sugar is said to be present in the urine of the fœtus; of women when suckling, and of some old persons; it is seen in the urine during convalescence from some acute disorders, especially cholera; in malarious diseases; and in carbuncle. Certain injuries of the nervous system also bring on glycosuria.

Diabetes insipidus is characterised by the passing of a large quantity of clear, colourless urine, of low specific gravity (1,003 to 1,007) devoid of sugar and albumen. The complaint is usually attended with thirst, harsh skin, and feebleness of body and mind.

Tests for bile.—There is a permanent froth on shaking; the colour of the urine is dark; white filtering paper dipped in it is coloured yellow when bile is present.

Test for bile pigments.—Allow a drop of strong nitric acid and another of the urine to run together on a porcelain dish. If bile pigments be present, a play of colours will appear at the point of contact, first green, then violet, blue, and red, representing the various stages of oxidation of the colouring matters. The most characteristic is green.

Caution.—Any urine which contains a large quantity of indican will give a blue, or violet, and even green colour with nitric acid. The green colour is, however, rarely seen with any other substance than bile pigments.

Test for the bile acids.—Hope's.—The urine must be rendered faintly ammoniacal with caustic ammonia, and then diacetate of lead added, as long as a precipitate occurs. The precipitate must be collected on a filter, and washed with distilled water, then boiled with alcohol over a water-bath, and filtered while hot. To the filtrate a few drops of a solution of potash or soda are to be added, and the solution evaporated to dryness over a water-bath. The residue is again to be boiled with absolute alcohol over a water-bath until a little be left, this must then be thrown into a great excess of æther in a stoppered bottle, and after some time the alkaline salts of the bile will crystallize out. In order to prove that these crystals are salts of the bile acids, they must be dissolved in a little distilled water, and tested after the method of Pettenkofer as follows: dissolve some of the crystals in distilled water in a test-tube, and add strong sulphuric acid at first in small quantities to precipitate the bile acids, but afterwards in amount sufficient to redissolve them which renders the mixture perceptibly hot to the hand. A drop of syrup may now be let fall into the liquid, which then shows a play of colours, passing from pink to cherry-red, and from red to purple.

Pettenkofer's test should never be applied directly to urine; the bile acids are never present in sufficient quantity to give the reaction, however modified, and the urine in jaundice frequently contains a small quantity of albumen which gives a reddish-violet reaction with sugar and sulphuric acid, while the action of the acid upon other constituents of the urine renders it impossible to be sure of the distinctive colours of Pettenkofer's test.

CHAPTER XXIII.

THE EXAMINATION OF THE INTESTINAL DISCHARGES.

The function of the intestines is to aid in the digestion and absorption of food, and to lubricate and pass on material entering them from the stomach. Numerous glands, many of which secrete mucus, exist in the walls of the intestines. Into the duodenum are poured the bile and pancreatic juice.

Diarrhœa is the discharge in excess from the intestines of more or less liquid matter (not blood or pus). It means generally that there is both increased peristaltic action of the intestines and an unusually liquid state of their contents.

Constipation means the retention in the bowels of excess of fæcal matter. It may be due to *mechanical obstruction* in some part of the alimentary canal; to *deficient peristaltic action* of the intestines; or to *deficiency of the secretions.*

In all cases of irregularity of the bowels ascertain its duration; the number of stools passed in the twenty-four hours, and their relation, if any, to the taking of food. Inspect the stools and note their character. They may be normal in consistence; very hard and dry; or more or less liquid. Note the colour, shape, and whether the odour is unusually fetid or not. The principal varieties of loose stools are *fæculent*; *lienteric*, when they contain fragments of food; *bilious*; *serous* or watery, also called *flux*; *mucous* or gelatinous; *bloody*; *fatty*; *purulent.*

The stools should be examined for worms and their ova. The worms most commonly found in India are the *ascaris lumbricoides*, the *oxyuris vermicularis*, and the *anchylostomum duodenale.* Occasionally *gall stones* are found in stools. Under the microscope special organisms, such as the *bacillus typhosus*, may be discovered.

Dr. Graham Brown quotes from Professor Nothnagal the following observations regarding the examination of the fæces in catarrhal affections of the bowels. The evacuation of pure mucus from the bowel without any admixture of fæces points to catarrh of the rectum; when firm fæces are passed completely enveloped in mucus, we may conclude that the morbid process affects the lower part of the colon and rectum. The admixture of mucus with the fæces in abnormal quantity is not always apparent to the naked eye; it often happens that when the fæculent matter is examined microscopically there are found scattered intimately through it small masses of mucus, which are whitish grey, hyaline and transparent; this peculiar admixture of mucus indicates that the catarrhal affection is limited to the upper portion of the large intestine (and possibly the small intestine), while the rectum and descending colon are free from disease. When the stools contain small masses of mucus tinged yellow with bile pigment, we may conclude that the small intestines have become affected. In normal fæces the reaction which is characteristic of bile pigment cannot be obtained; but when, from whatever cause, the peristaltic action of the small intestine is increased, this characteristic play of colours will be seen on the addition of nitric acid.

THE EVACUATIONS IN DYSENTERY.

In acute dysentery the stools at first are often semi-feculent, or consist of hard scybalæ, but they soon assume the special dysenteric characters, becoming scanty, slimy, or gelatinous from the presence of mucus, and bloody. They have a very offensive and characteristic odour. They are often most frequent at night or in the early morning. Usually the different matters in the stools are more or less mixed, the more so the higher the disease is situated. If the rectum is chiefly affected, the blood is less intimately mixed, while the stools are more muciform. Sometimes scybalæ are passed covered with mucus and blood. Later on the stools may change in their characters, becoming exceedingly offensive, muddy looking, dark, and often watery and copious. Pieces of membrane like 'washed raw meat' may be noticed. Sometimes a large quantity of pure blood is passed. Sloughs of the mucous membrane may be expelled.

Chemically the stools yield a large proportion of albumen, even when there is little or no visible blood. They are alkaline in reaction, and contain much carbonate of ammonium. Microscopically they present abundant epithelial cells, blood corpuscles, pus-cells, and remnants of the membrane. Peculiar cells, micro-organisms, and other bodies have also been described.—(Roberts.)

In chronic dysentery the stools are usually more or less liquid, presenting a mucous, serous or bloody appearance, with an admixture of fæces; sometimes they are either reddish brown, pale and frothy, muco-purulent, or actually purulent. The peculiar odour is retained more or less, and may be very intense.—(ROBERTS.)

THE EVACUATIONS IN ENTERIC FEVER.

There is usually diarrhœa, but there may be constipation. Sometimes intestinal hæmorrhage occurs. The stools may be very frequent. Generally they range from three to six in twenty-four hours.

At first the fæces present no peculiarities, but after a few days they assume special characters, becoming thin, yellow pultaceous, and somewhat resembling 'pea-soup' in appearance; very offensive, and often ammoniacal; and alkaline in re-action. Uniform throughout when first passed, they separate on standing into an upper watery layer, of a yellowish or brownish colour, containing albumen and salts in solution, the latter including chloride of sodium and carbonate of ammonium; and a lower layer or deposit consisting of the remains of food, epithelium and mucus corpuscles, blood, small yellow flocculi, shreds of slough, and crystals of triple phosphate.—(ROBERTS.)

A peculiar bacillus (bacillus typhosus), discovered by Eberth and the cause of enteric fever, has been observed in the stools.

THE EVACUATIONS IN CHOLERA.

Occasionally death occurs, though there has been little or no purging or vomiting. In most cases, however, purging is the first symptom.

The stools are very profuse, watery, at first coloured by the previous intestinal contents, but soon presenting peculiar characters and being named 'rice-water' stools from their resemblance to water in which rice has been boiled. At this time they are perfectly liquid, exceedingly pale, somewhat opalescent or occasionally whitish or milky, having but little odour. When this liquid is allowed to stand, more or less sediment falls, resembling flakes of boiled rice, leaving a whey-like fluid above, which has a specific gravity of from 1,005 to 1,010, and a neutral or slightly alkaline reaction. Chemically the evacuations consist mainly of water, holding in solution a considerable proportion of salts of soda and potash, especially chloride of sodium, with but very little albumen or other organic matter. The sediment has been supposed to be modified fibrin or mucus. In the later stages of cholera blood may be passed by the bowel.

Microscopically various objects have been described. By far the most important is the *comma-bacillus* of Koch, which he regards as the cause of cholera. It occurs in curved rods, actively mobile, spirilla and threads.—(ROBERTS.)

PART II.

CHAPTER I.

TREATMENT OF EMERGENCIES.

Definition.—There is hardly a single variety of disease which might not occasionally arise in the form of an emergency; the young surgeon will do well to bear this in mind, and to attend all cases promptly when called upon. The word emergency in our sense includes primarily such cases as would in all probability end disastrously, if not exactly fatally, were they not at once attended to. It is to such cases as these that the following brief chapter is devoted. Where it is life itself that is endangered, the surgeon's first idea must be to save the life: the refinements of treatment can well stand over till a more fitting opportunity. Take a case of strangulated hernia for example. Now and again such a patient loses his life through the eagerness of the surgeon to perform a tedious radical cure in addition to the reduction of the bowel. The proper course for a young surgeon to pursue in such cases is to place the patient out of immediate danger by reducing the bowel, and then, after a few days or perhaps weeks, when the patient has regained strength, the radical cure might be undertaken. Surgeons of much experience will be able, of course, frequently to discriminate cases where the double operation may safely be performed; but even experienced surgeons are frequently mistaken, and on the whole it would be well for all to adhere to the line of treatment indicated above.

In this chapter we shall have little to say on the subject of diagnosis. It will be presumed that the reader is fairly expert in this respect.

It was the writer's intention at first to attempt a classification of the cases that might be included under the head of emergency, according to the system (respiratory, circulatory, or nervous) which was most immediately concerned in each case. A consideration of some of the most trying emergencies, however, demonstrated such a classification an impracticable one, for, two or more systems were seen to be involved more or less in each case. For example, one of the most serious emergencies we have to deal with here is a severe lacerated wound, say, of the foot or hand, but especially of the foot. There may be severe hæmorrhage, or fracture of bones, or dislocation, or all three combined, and yet it is not one of either of these conditions that causes any uneasiness to the surgeon: it is the chances of the onset of *tetanus* that is ever uppermost in his mind in cases like these.

No such classification has, therefore, been attempted, and the reader is recommended to consult the index for the treatment of any particular emergency with which he may have to deal. We shall now take up the consideration of the different cases, no particular order being observed.

HÆMORRHAGES.

Preliminary treatment.—As the hæmorrhage will usually have been going on for some time before the surgeon's arrival, he will often find that the treatment of the general condition induced by it, and which is most frequently a condition of shock or collapse, will require more immediate attention than the hæmorrhage itself. Indeed in cases where collapse has supervened, he will often find that the bleeding has ceased. If the collapse is very marked, the surgeon will have to proceed with great care and gentleness. Life is flickering, and a little rough handling or exposure to chill may extinguish it. If the bleeding has already ceased, the greatest care should be taken not to set it going again. If it has not ceased, it should be temporarily arrested by one of the methods hereafter described (page 291 *et seq.*), and undivided attention then given to the general condition. The patient must be kept quiet in the horizontal position; the body heat must be conserved by means of warm blankets and hot bottles, and he is on no account to be placed in a sitting or upright posture. The hot bottles are to be placed close alongside the body, well into the armpits, and between the thighs, taking care that a fold of blanket always intervenes between the bottles and the skin. A few drops of equal parts of hot brandy-and-water are to be given every few minutes. It is to be trickled slowly upon the tongue. If poured into the patient's mouth it will probably suffocate him. Half a drachm of ether may be injected subcutaneously, and unquestionably with great benefit in many cases. This quantity may be repeated if necessary in ten or fifteen minutes.

Intravenous injections.—If there is great blanching of the mucous membranes or other still more certain evidence of the actual loss of a large quantity of blood, intravenous injection of 10 to 20 ounces of a solution of common salt (98° F., 2 grains to the ounce)* should be performed. For this purpose the only apparatus necessary is the canula of an exploring trocar, a piece of india-rubber tubing six inches long and wide enough to fit over the rim of the trocar, and a glass syringe, the nozzle of which is to be introduced into the other end of the india-rubber tube. The veins at the front of the bend of the elbow are to be exposed—and this may require some little dissection, as they are often rather difficult to find owing to their bloodlessness—the largest one selected, and a double catgut ligature passed beneath it with an aneurism needle. One of these ligatures is intended to tie the canula in the vein, the other to close the vein behind the point of entrance of the canula. Before inserting the canula in the vein, it and the tube and syringe are to be filled with the salt solution. Having fixed the canula properly, the solution is to be gently forced onwards into the vein by means of the syringe. If more than one syringeful is to be used, the rubber tubing is to be compressed by an assistant and so held that none of its contained fluid shall escape while the syringe is removed, refilled, and its nozzle re-inserted in the tube. The writer on one occasion, when making an intravenous injection of common salt with an extemporized apparatus such as here described, used a piece of tubing about 2½ feet long, and, using the cylinder of the syringe as a funnel, made a successful injection simply by allowing the solution to flow in by gravitation. Whether the syringe be used as such, or only its cylinder as a funnel, *care should be taken not to allow it to become more than three quarters empty before being refilled.* If this simple precaution be exercised, air will not be introduced into the vein.

Instead of a solution such as the above, many writers still advocate transfusion of blood, although it has been long pretty well established that the injection of blood possesses no special advantages, and is, in fact, except where carried out by skilled hands and with a special apparatus, not a little dangerous to the patient, not to speak of the injury frequently inflicted on the self-sacrificing giver of the vital fluid.

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* *Vide British Medical Journal*, 16th February 1889, page 363.

Auto-transfusion.—A process known as *auto-transfusion* has been found useful in cases of severe hæmorrhage. If the brain and heart can be kept well supplied with blood, irrespective of anæmia elsewhere, till the general condition of collapse has passed off, it is believed that the chances of the patient's recovery will be somewhat improved. To effect this, the upper and lower limbs are entirely enveloped in a rather tight elastic bandage. Martin's elastic bandages being the best to use. In this way the blood in the limbs is driven into the trunk and head, and must of course increase the supply to the head and heart. The writer saw this *auto-transfusion* tried once, but without any obvious advantage. The case, however, was a very hopeless one, for the hæmorrhage had occurred in the case of a patient already terribly debilitated by the cancerous cachexia.

Collapse.—There are certain circumstances in which it is very doubtful whether the surgeon should immediately attempt to establish reaction from the collapse of hæmorrhage. For example, if the collapse is due to a violent hæmorrhage from a punctured wound in a deep vessel which has ceased to bleed before the surgeon's arrival, he should not be in too great a hurry to establish reaction (Harrison Cripps). The enfeeblement of the circulation which is so marked in collapse affords an excellent opportunity for the formation of a useful coagulum in the wounded vessel. The longer therefore the collapse remains, consistent with safety to the patient, the firmer will the coagulum become, and the more likely to form an efficient obstacle to a renewal of the hæmorrhage. In such cases the surgeon must be guided entirely by the condition of the patient. If he is satisfied from the general indications present that the collapse is not dangerously profound, the only treatment should be to keep the patient warm with blankets. Ether injections and brandy, either by mouth or rectum, should be withheld. It will be a comfort to the sufferer to allow him to drink a moderate quantity of water, or suck pieces of ice to allay the intense thirst so commonly present in these cases.

We shall now turn our attention to the treatment of the source of the hæmorrhage. We shall consider wounds of arteries first; then wounds of veins; and finally cases of an exceptional character which might be either arterial or venous, or both. Want of space will not permit of the discussion of the different methods of procedure recommended by different surgeons. For such discussion the reader is referred to systematic treatises on this subject, and particularly to the able articles by Mr. Harrison Cripps in Heath's *Dictionary of Surgery*.

Before attempting an examination of the wound, the patient should be so placed that the wound will be in a good light. Nothing is more unastisfactory than attempting to look for bleeding vessels in deficient light.

ARTERIAL HÆMORRHAGE.

Hæmorrhage from arteries in open incised wounds.—If the wounded artery presents immediately on retracting the edges of the wound, both ends should be tied when the vessel is found completely divided; if it is only punctured a ligature should be placed on either side of the puncture and the vessel divided at the puncture. If the vessel does not present at once, the wound may require to be enlarged in the direction of the known course of the arteries at the seat of the wound, and a little careful search instituted. Occasionally, a small artery near the surface in vascular parts, such as *the scalp*, will be difficult to find, and further dissection will only increase the hæmorrhage; in such cases a stout pin passed beneath the source of hæmorrhage will often arrest it, if pressure by a pad fail, either alone or with a figure-of-eight ligature in addition, over its free extremities. The ligatures applied to all vessels in external wounds of the body should be of gut or tendon, and should be cut off short. Silk or other material should only be used when gut or tendon is not available, and the ends should be left long enough to hang out of the wound so that they may be easily removed when they have cut through the vessel to which they have been applied.* Many surgeons cut silk ligatures off short and leave them buried in the wound, which is then sutured close over them, and apparently without any hurt. The writer, however, strongly deprecates this practice. It has been his duty on very many occasions to remove such buried sutures months after the patients had been discharged from hospital with their wounds to all appearance soundly healed and no indications of irritation at the site of the ligatures; nevertheless, the ligatures subsequently set up irritation with suppuration and the formation of sinuses, and exploratory incisions for their removal have to be made. The material known as *tong-goose* if used for ligaturing arteries should also be left hanging out of the wound, otherwise it will eventually give rise to much irritation and pain on account of its wiry texture. The writer has known a patient to have to submit to three different exploratory operations within eighteen months for the removal of these *tong-goose* ligatures in a case of elephantiasis of the scrotum where they had been used for tying the bleeding vessels and had been cut off short. Good common gut or tendon is perfectly safe for any vessel from the size of the common iliac artery downwards, and ought, of course, always to be cut off short. When hardened for a long time, however, it will resist absorption for a very considerable period and may eventually find its way to the surface in suppuration.

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* *Note.*—Silk, when thoroughly disinfected, and the conditions of the wound favourable, may be cut short; the buried part will be absorbed, giving no trouble. These conditions, however, are so difficult to secure that the directions given above had better always be followed.

Having carefully arrested all bleeding, the edges of the wound should be carefully sutured and the dressing applied. (Even when the edges of the wound are much lacerated, as close approximation as possible by sutures should always be carried out, and it is wonderful what results will often be achieved in this way even in cases where the edges of the wound seemed to be injured beyond hope of recovery. It should be remembered that a lacerated wound is frequently practically an incised wound where the incision has run a very irregular course. Where there is much contusion in addition to laceration, the edges should not be drawn together, nor any other obstacle offered to the free exit of the copious discharge which in such cases is inevitable.) In suturing a wound the surgeon should remember that the only use of the sutures is to approximate the *edges* of the wound so that the epithelial structures of opposite sides shall lie in contact and fuse together at once. The edges of the wound are not to be dragged *tightly* together. So long as there is any tension between the raw surfaces there will be no healing. What does happen then is, suppuration sets in in the compressed tissues, causing them to break down, thus automatically dissipating the tension; then, and not till then, will granulation set in. So the edges are simply to be kept lightly in contact if healing by first intention is desired. No antiseptics, however elaborate, will heal a wound by first intention if the points above indicated be neglected. Many a time complaints are heard of the want of success in the rapid healing of a wound notwithstanding that no detail of Listerism was omitted. The fault lay, not in the Listerism, but in the neglect of the surgeon to thoroughly approximate the edges of his wound throughout its entire length, not leaving a sixteenth of an inch of it unapproximated, and that without undue tension anywhere. It should be noted that the edges of a wound always swell a little after the dressing has been applied, and this point should be borne in mind and the swelling allowed for during the insertion of the stitches. This is rather a diversion from the subject in hand, but the irregularity of its insertion here may help to impress it on the reader's mind—a point which, hardly second even to Listerism, is a distinguishing feature of modern surgery.

Treatment when the bleeding is from a punctured wound.—Here it may be very difficult to say what vessel is wounded. For example, hæmorrhage from a punctured wound in the fold of the buttock may be due to a wound of the superficial femoral by the tip of the instrument that caused the puncture. Consequently it will not always be right to commence a dissection straight off—the patient might thus be killed, either by the anæsthetic if the operation of dissection were prolonged, or by fresh hæmorrhage from newly divided vessels. And it is possible that we might not be able to find the injured vessel at all, for the deep tissues will be found infiltrated and discolored with blood and their relations probably also considerably altered. The treatment will vary both with the depth of the wound and with its situation.

Treatment, the bleeding having already ceased.—Suppose the *bleeding has ceased* when the surgeon arrives. The part is to be exposed, if covered, by *cutting* the clothes away. There will be a clot filling the wound more or less completely. If there is collapse, it is to be attended to in the manner already described (page 220). The patient is to be kept very still. A couple of folds of lint are to be placed over the wound and kept moist with cold, if possible, iced water. *Compresses and bandages are to be avoided* lest the clot in the wound be displaced. This treatment should be continued for several days, rest being strictly enjoined. As the surgeon cannot be present throughout the interval that must elapse before all danger of hæmorrhage recurring has ceased, and as recurrence may at any moment take place, an elastic band or tourniquet or other device should be kept at hand to apply to the supplying vessel immediately any re-appearance of hæmorrhage occurs. A simple device, when skilled assistance is not available and the wound is below the shoulder or hip joint, is to tie a towel very loosely round the affected limb as high as possible, and then, should hæmorrhage occur, a piece of stick, say a walking stick, may be placed in the loop of towel and twisted so as to constrict the limb. The limit of the tightness of the compression thus applied is indicated by the cessation of the hæmorrhage.

Treatment, the bleeding still continuing.—But if the *bleeding is going on* when the surgeon arrives, it must be at once controlled by the pressure of his fingers at the wound or on the supplying artery higher up. If he has a tourniquet with him, it ought to be applied as soon as possible to the point best suited for controlling the hæmorrhage in each particular case. For wounds in the upper limb the brachial, and in the lower the femoral should be compressed. The circulation in the brachial is arrested by pressing the artery against the humerus; in the femoral by pressing it against the neck of the femur below, but close to, Poupart's ligament (MacCormac). Pressure in the supraclavicular hollow will arrest the circulation in the subclavian. This is of course of only a temporary measure, but it will give the surgeon time to think. He is not to act precipitately. If he does, he will probably have to do everything over again with the patient in a much worse condition to bear handling. He must enquire how the injury was caused, the position of the patient when the injury was inflicted, the nature of the body that caused the injury, particularly its length, and whether it broke off in the wound or not, &c.; in this way he will be able to form a tolerably accurate idea as to the depth and direction of the wound, the degree to which it is contused, the probability of foreign bodies being in it, such as a bit of the instrument that inflected the wound, or clothing or dirt, also the depth beyond which he may consider the blood vessels uninjured.

If the wound is shallow and is situated over the main vessel of the limb where that vessel is not deep, as along the course of the brachial, or in a position such as the middle of the neck where effectual pressure is impracticable, the wound should be enlarged and the vessel sought for and ligatured above and below the seat of the injury.

If, however, the wound be judged to be deep and in a position in which the main vessels are deeply situated as in the lower half of the thigh, the calf, the upper third of the forearm, and the hand, pressure is to be tried before resorting to an exploratory operation for finding the wounded vessel (Cripps). In the case of the palm of the hand, where the deep arch has been wounded by a pointed instrument, it should be remembered that the vessel lies beneath the tense palmar fascia and cannot therefore be compressed till the fibres of this fascia have been freely divided at the seat of the puncture (Alexander Gordon).

The application of pressure.—It is obvious that pressure must be applied differently according to peculiarities on the situation of the wound. The following points ought here to be borne in mind :—"Blood may be furnished at either end of the divided artery ; pressure is not only required over the wound, but along the course of the artery above and below it; pressure must never be concentrated at a single point, but disseminated along the course of the vessels, for by distributing the pressure much less is required to arrest the bleeding than if it be applied to the wound alone ; the whole quantity of blood in a limb may be lessened by careful bandaging from below upwards."

Application of pressure to a wound in one of the limbs.—The first thing to do is to apply a graduated compress, a couple of inches in depth (or more if the wound be very deep), over the wound itself, and fix it there with a couple of straps of sticking plaster. The limb is then to be evenly and firmly bandaged throughout its whole length from below upwards, the bandage ending in a spica above. This bandage, when it reaches the level of the wound, is not to be carried over the graduated compress, but above it, and then continued upwards. The object of this bandage is, primarily, to diminish the total quantity of blood in the limb. The next step is to make firm, narrow pads which are to be placed along the course of the main vessel above and below the wound. These can be made of calico sewn into narrow long bags which are to be stuffed with *tow*—not cotton—and which for the lower limb should be about the diameter of an average plantain, but somewhat narrower for the upper. An assistant is to hold these compresses in position till they are bandaged on firmly. This bandage, like the first, is also to skip the seat of the wound itself. The object of these compresses is to control the circulation in the main vessels above and below the wound. Finally, a bandage is to be applied firmly round the limb over the graduated compress, and the limb lightly but carefully secured on a splint to ensure absolute rest. This pressure can be kept up usually for eight or ten hours. If the patient is restless, a quarter of a grain of morphine hypodermically will be useful. By pressing the toes occasionally and noting whether the blood is easily pressed out of the capillaries and as easily returns, the efficiency of the circulation in the limb for its safety can be readily ascertained. After twelve hours, when, in the great majority of cases of primary hæmorrhage, we may consider the clot within the vessel to have acquired sufficient firmness to prevent recurrence of the hæmorrhage, the bandaging may be relaxed a little here and there by a snip with the scissors. The relaxing process, however, ought to be very gradual, so that at the end of a week a certain amount of compression should still persist.

Sometimes a pad or a bandage will have been relaxed too soon, and the hæmorrhage will then recur. If the state of the limb and of the patient permit, it will generally be well to give the bandaging another trial; if not, the patient should be anæsthetised, the wound enlarged and the vessel dissected out and tied. In certain cases it is better surgery to tie the main artery of the limb than to attempt to look for the wounded vessel at the seat of the wound. For example, the brachial should be tied in intractable hæmorrhage from the deep palmar arch.

VENOUS HÆMORRHAGE.

If the vein can be got at easily, it ought to be ligatured when completely divided, if only punctured at one side and it is a large vein, the wall around the puncture should be pinched up by a bow-forceps and a ligature applied around the puncture. In this way the channel of the blood vessel is not obliterated. If the punctured vessel is a small one, it is better to tie it on either side of the injury. In other cases, as in *punctured wounds* of the limbs, the part should be elevated if possible and pressure applied directly over the wound and to the veins a little below it. No pressure *above* the seat of injury should be attempted. The part should be kept at rest. Cold applications locally are also useful.

Hæmorrhage from the sinuses of the skull in fractures of the cranium.—This is often very alarming, but is usually easily arrested by simply keeping the head well elevated and applying light pressure with a sponge.

Hæmorrhage from ruptured varicose veins.—This may prove almost immediately fatal if the varicosity be very large and the patient in the upright posture at the time of the rupture. The horizontal position should be immediately assumed, and an antiseptic pad of lint bandaged pretty firmly over the seat of rupture. The limb should then be well raised and kept at rest for a few days. To secure steadiness to the limb, a splint might be applied, but a Salter's cradle will generally suffice. No attempt at a radical operation for the treatment of the varicose condition should be thought of till the patient is fairly restored to health.

Hæmorrhage from the corpus spongiosum urethræ or from corpus cavernosum penis.—Hæmorrhage here is frequently very persistent, and in fact sometimes fatal in young persons if neglected or improperly treated. It may come from the interior of the penile urethra, when, after seeing there is no foreign body present, a large sized gum-elastic catheter should be introduced and the penis carefully bandaged *from the tip of the glans to the root* by a one-inch calico bandage. The *tip* of the glans penis should remain exposed so that the surgeon may be able to ascertain from time to time whether the circulation in the penis was sufficiently maintained to secure the integrity of the organ. Cold applications may be used as well, in the form of icebags or evaporating lotions, but the tightening of the bandage that will take place on wetting it ought to be borne in mind, lest the pressure on the tissues of the penis be too great for safety.

If it is an external wound that has to be treated, the first thing to be done, if it can be done, is to bring the edges of the wound into the closest possible apposition by fine sutures, and then having placed a fold of dry lint over the wound, apply pressure if the bleeding continues, just as was described above in bleeding from injuries to the interior of the penile urethra. If bleeding still persists, and it sometimes will, nothing is better than the actual cautery, Pacquelin's if at hand; but the end of a thick iron wire heated to redness and applied very lightly does admirably. Of course if any of the arteries of the penis have been wounded, they should first be ligatured. The reader will notice that all such remedies as perchloride of iron, matico, &c., have been omitted from this description of treatment. The use of a sponge wrung out of water as hot as can be borne by the hand ought to be tried for a few minutes, and, failing, the directions above laid down should be followed. Matico, perchloride of iron and all the so-called styptics ought to be avoided. They are mostly worse than useless. Very intractable hæmorrhage sometimes follows amputation of the penis in front of the scrotum. On one occasion the writer was obliged to pass a hare-lip pin between the bleeding corpora and constrict them separately by means of a stout silk ligature twisted round the ends of the pin, the urethra of course being carefully excluded.

Hæmorrhage from the socket of a recently extracted tooth.—This is sometimes very severe, and in elderly plethoric persons is often of very serious moment. Plugging the socket firmly with lint saturated with the tincture of the perchloride of iron generally suffices. If not, the best plan is to fold a piece of lint into a firm pad just wide enough to fit into the vacant space left by the tooth and thick enough to rise well above the crowns of the neighbouring teeth. The mouth is then firmly closed and the pad thus thoroughly pressed into the bleeding socket by the opposing teeth of the other jaw. This pressure should be maintained for twenty-four hours, and to enable this to be effected, the mouth should be kept closed by a bandage passing beneath the lower jaw and over the crown of the head.

Hæmorrhage from the nose.—Cold should be tried externally and a firm plug of lint soaked in tincture of iron inserted into the anterior bleeding naris. The patient should be kept in a sitting posture and have all tight articles of dress removed from the neck and chest. This will mostly suffice. If not, both the anterior and posterior nares should be plugged, a small gum-elastic catheter being almost as useful for inserting the ligature as Bellocq's sound. After this proceeding the bleeding will sometimes continue through the lachrymal ducts, but never for more than a few minutes. The upright posture should be maintained for some hours after the bleeding has ceased.

HÆMOPTYSIS.

Hæmoptysis.—There can hardly be a more distressing spectacle than that presented by a patient coughing up large quantities of blood. It is to cases such as this that the term emergency may well be applied, and for which immediate treatment seems urgently demanded. Yet, hardly anything can be done at once. The patient will not lie down, for he feels suffocated in the attempt. So he must be gently supported by the hands applied to his axillæ and forehead till the paroxysm has passed off.

He is not to be crowded round with blankets and pillows. If the surgeon has some ergotine with him, he ought to administer a dose hypodermically, 3 to 10 minims of the injectio ergotini hypodermica. The ergotine ought to be fresh. "All the preparations of ergot become quite inactive if kept for any length of time" (Brunton), and this, doubtless, is more markedly so in India than in England.

After the paroxysm, the patient either dies or sinks back greatly exhausted. In the latter case he ought to be kept very quiet, no attempt being made to ascertain the source of the hæmorrhage just yet. If the attempt be made hæmorrhage will very likely recur. The only thing to be done now is to order a full dose of ergot, say, half a drachm to a drachm of the liquid extract, to be repeated every two or three hours. It is not wise to repeat the hypodermic injection of ergotine, as great local irritation is often produced by it. The covering of the patient should be light, but the feet ought to be kept warm. When he has recovered a little, say in half-an-hour, little bits of ice to suck will be useful and are generally acceptable to the patient, though by no means always. If now he can be got to lie on his back, he should be placed with the head and shoulders well raised, and dry cold may be applied over the sternum in the form of an icebag. Here again the patient's feelings must be consulted, for if the application is badly borne, it will be worse than useless. Care should be taken to prevent the patient getting wet by the tricking around him of the moisture condensed from the air on the surface of the icebag. The physician can now also *auscultate* the front of the chest, but nothing further in the way of physical examination should be attempted till the hæmorrhage has completely ceased for a few days.

If the patient is much troubled with cough, a quarter of a grain of morphine may be given hypodermically. His food should be in the shape of nutritious fluid and should be given cold; stimulants should be avoided.

HERNIÆ.

Femoral and inguinal herniæ.—The following remarks have reference chiefly to cases of inguinal and femoral herniæ. The general principles enunciated apply to intestinal herniæ of all kinds.

History of the case.—When a case of hernia presents itself, the surgeon should be very brief and pointed in his queries as to the history of the case if symptoms of obstruction are present or setting in. Whatever the history, the bowel should be reduced without delay. It is impossible in most cases to form an exact opinion as to the exact condition of the bowel in the sac. It is likely to be more seriously constricted in small recent herniæ than in large old ones. The case may not, for a day or so, have appeared very distressing, nor may it have appeared so when afterwards seen by the surgeon. The bowel may, however, at the same time have been constricted even to perforation. The general condition of the patient in regard to pain, collapse, &c., sometimes affords very little information as to the condition of the bowel. Patients of different nervous constitution will present very different phenomena from the same amount of strangulation of the bowel, or even from its perforation. Sometimes the patient seems relieved when perforation sets in. So the surgeon must be on his guard.

Treatment when anæsthetics and instruments are available.—Seeing the great uncertainty there is in diagnosis and the terrible injury that may be done by injudicious pressure if the bowel happen to be in a critical condition, no manipulation should be applied beyond what may be necessary to ascertain as accurately as possible the nature of the contents of the sac if the surgeon has his pocket case and chloroform at hand. The patient should be placed under chloroform at once. This will induce great muscular relaxation, so that if the bowel be not very tightly held, very slight taxis * may reduce it. But if very gentle manipulation does not reduce it, the sac must be opened and the state of its contents calmly investigated. The forefinger should be passed up within the sac to the seat of constriction and the constricting band divided with the hernia knife. In dividing the constricting band it is never necessary to give a sawing motion to the knife. The palmar surface of the tip of the forefinger in the ring should be pressed firmly against the rigid band and the hernia knife then passed in between them on its flat. By maintaining the pressure and simply turning the edge of the knife forwards towards the band the latter is instantly severed. The knife is once more turned on its flat and withdrawn. Important blood-vessels can thus hardly ever be divided.

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* Brigade-Surgeon Sibthorpe informs the writer that the external ring may often be stretched while the patient is under chloroform by passing the forefinger into it and pulling on its fibres till they give way. This of course should only be attempted when the operator is *absolutely certain* of the integrity of the bowel.

The stricture divided, the bowel may be drawn out a little to examine the constricted part. If the bowel is not seriously damaged and other conditions favourable, it is to be returned at once. Any limited adhesions found to exist between the bowel and the sac are to be divided, if necessary, between ligatures. If the hernia is a very large one of very old standing, it will be well to remain content with dividing the stricture only. If such a bowel is to be reduced it can only be done after much manipulation, and this, together with the pressure to which it will be subjected within the abdominal cavity, may induce fatal collapse or intestinal obstruction. Should the hernia contain a large mass of omentum presenting any difficulty in reduction, the omental mass should be removed close to the ring. Two close rows of ligatures should first be inserted, and the omentum then divided immediately beyond them.

Suppose the bowel to have been reduced and the patient's general condition satisfactory as indicated by a steady pulse and a dry warm skin, the sac is to be pulled well down by an assistant and its neck ligatured as high up as possible by a stout piece of gut or tendon, securing the ligature by passing one end of it through the neck of the sac an eighth of an inch lower down and putting on another knot. The ends of the ligature should be cut off short. The knot must be a "surgical knot"; the "granny" knot will slacken and allow a communication between the external wound and the peritoneal cavity which will usually induce a fatal peritonitis. On the assistant releasing the sac its constricted neck will disappear into the upper limits of the canal if the ligature has been put on high enough. The next step is to make an incision two inches long in the fundus of the scrotum and corresponding part of the sac and suture the edges of the wound in the sac to those of the scrotal wound by many sutures. A drainage tube is then inserted into this opening and brought up within the sac as high as the orifice originally made in it to reach the bowel. After thorough irrigation with 1 in 10,000 corrosive lotion, the original wound is to be accurately sutured, a bit of wet corrosive lint applied over it, then a thick pad of cotton wool and a spica bandage.

This dressing should not extend down over the scrotal wound; a separate pad and a T-bandage should be applied there, so that if the discharge is abundant this pad may be renewed without disturbing the general dressing.

Another method of dealing with the sac after the application of the ligature is simply to separate the sac completely from its surroundings and cut it off half an inch below the ligature. The exposed tissues are then freely dusted with iodoform and the wound accurately sutured, no drainage tube being used. The sutured wound is dusted with iodoform and dressed with a piece of lint and a cotton or finely prepared oakum pad and bandage. The wound heals by first intention.

But, suppose that after the reduction of the bowel the patient is found to be in a collapsed state, thready pulse cold and dewy skin, the operation must be terminated as rapidly as possible. The peritoneal wound is to be sewn up at once with a continuous suture to secure thorough closure of the peritoneal cavity. A fine gut or tendon suture is the best to use, but very fine silk will do very well and may be cut off short. Having arrested every point of hæmorrhage, the sutures are to be inserted in the superficial wound and left untied till a further examination of the wound for bleeding points has been made and any new ones discovered secured. The sutures are to be tied with great care so as to avoid any undue tension in any of them, and to secure accurate adaptation of the edges of the wound. Finally, an antiseptic dressing and a spica bandage are to be applied and the wound will heal by first intention.

But there is a third and very serious set of circumstances to be mentioned, that, namely, in which the bowel is found either gangrenous or so much inflamed that the surgeon anticipates gangrene will immediately follow the return of the bowel into the abdomen. Nothing taxes a surgeon's discriminating power more than the forming of an opinion in such cases as to whether the bowel has or has not reached the limits beyond which it could not be returned with safety into the abdominal cavity. The writer has seen such extraordinary recoveries where the bowel was reduced though seemingly on the very borders of gangrene that he is almost tempted to lay down the rule, "When in doubt return the bowel"; but this is an unsatisfactory method of settling any question, so the advice of Mr. Frederic Treves, which seems as good as any, is here given *verbatim* : "The state of the bowel can be better judged from its consistence than from its colour. So long as the gut appears sound externally, and feels firm and resilient to the touch, it may be safely reduced. The colour of the loop alone is no true test of its condition. The surface of the gut is often dull and sticky from peritonitis. This condition is in itself no bar to reduction, but it should be noted that such a loop after reduction will probably acquire adhesions to some part of the serous lining of the abdomen. Flakes of lymph upon the surface of the gut should not be disturbed if the gut seems generally in fair condition, since they often hide minute perforations.

If the bowel be gangrenous or ruptured, the whole part involved should be well exposed and then resected; the part removed should include a little more of the intestine than the part actually gangrenous. When a pinhole perforation exists, if the gut be gangrenous about the perforation the dead segment should be excised. If its condition be doubtful, the loop should be fixed *in situ* by means of sutures that penetrate no deeper than the muscular coat. All the constriction having been relieved, an artificial anus is established, which may be dealt with subsequently. If in any case the gut about the perforation appear really sound, then a minute eliptical portion of the bowel wall may be excised so as to include the fistulous aperture. The long axis of the ellipse should be parallel to the circular fibres. The margins of the wound should then be united by deep and superficial sutures and the loop returned into the abdomen."

The presence of a well-marked sulcus on the wall of the bowel at the seat of constriction is regarded by some as a contra-indication to returning the bowel. This is undoubtedly a serious condition, but so long as the floor of the sulcus is not grey, flabby and softened, the bowel may nevertheless be returned. So long as vessels in their continuity can be seen crossing the sulcus the bowel may be returned.

Such is a general outline of what should be done when the surgeon has a few instruments at hand and is in a position to anæsthetise his patient.

Treatment when anæsthetics and instruments are not available.—But when these facilities are not immediately available, various tentative means are recommended by different writers with the view of either reducing the bowel or mitigating the patient's sufferings.

Rest.—If it is concluded that the case is merely an *obstructed* or *incarcerated* hernia, the patient should be kept quiet and an icebag (if ice be available) applied over the tumour. In place of ice, evaporating lotions may be tried, or the ether spray ; even a rag applied to the part and kept wet by dropping ether on it often produces great benefit from the cold thus produced. If pain be severe morphine or opium may be administered. A full enema of soap and water should be at once administered and repeated if necessary. When the local symptoms have been relieved, a full dose of castor-oil will be useful.

Position.—Great stress is laid by some on the value of placing the patient in such a position that the pelvis will be on a considerably higher level than the shoulders, with a view to facilitate the reduction of the herniated bowel. Some even advocate the suspension of the patient by the legs from the shoulders of an assistant, the patient's legs being over the assistant's shoulders, their backs being in contact. Commonly, however, it is looked upon as sufficient to merely raise the foot of the patient's bed about a foot by placing blocks of wood under it. The plan may be tried, though it must be confessed that but little benefit is ever derived from it.

Hot baths.—Hot baths are also constantly used to facilitate the reduction of herniæ, though it is difficult to see how they can be other than hurtful, and they are therefore not recommended. When continued till faintness is induced whereby a certain amount of muscular relaxation is produced, it is possible of course that a hernia whose irreducibility depended on the muscular strain thus dissipated would then be reduced. But if muscular tension has not been the sole opposing cause, the bowel will not go back ; if it is a case of strangulation, the excitement from the bath, and from lifting and laying the patient will have undoubtedly intensified the local injury to the bowel, while if it is a case of incarceration it is very likely to be developed into one of strangulation ; and in any case the patient's general condition, if the bowel have not been reduced, will be found to be infinitely worse than if he had been let alone.

Ice.—If the case prove to be one of *undoubted strangulation*, a full enema should be given—one only ; icebags, if available, should be kept applied for four or five hours, when, if the bowel, by gentle taxis, do not go back, the ice should be removed and be substituted by evaporating lotions. During this time the patient is to be kept on his back and the abdominal walls kept as relaxed as possible by raising the head and shoulders slightly and flexing the thighs on the pelvis. Bits of ice to suck will be grateful to most patients; and hypodermic injections of morphine should be given sufficiently frequently to allay pain. Gentle taxis may again be tried, and, failing, the same treatment should be resumed. It is difficult to lay down any rule as to how long this palliative treatment should be continued. But the surgeon will not be far wrong who proceeds to operate even without chloroform as soon as unquestionable signs of intestinal obstruction manifest themselves. When a patient arrives at this stage, he will hardly complain of the little additional inconvenience experienced from such an operation, provided only the operator use a sharp knife with a swift hand.

After-treatment of strangulated hernia.—Although foreign to the purposes of this chapter, a word or two may be useful on the subject of the after-treatment, of cases of operation for strangulated hernia. If the patient is restless after the operation, a quarter of a grain of morphine under the skin is very useful. If he has been operated upon before an enema could be administered, a full enema of warm water should be given twelve hours after the operation. After the bowels have acted another quarter of a grain of morphine hypodermically will be useful. The food should consist of milk and conjee, with broth in addition if the patient's prejudices admit of it. If signs of peritonitis set in the case becomes serious and surgeons are divided in their opinions as to what should be done. Most surgeons give extract of opium in doses varying from a quarter grain every hour to one grain every other hour. The writer, following the advice of Mr. Lawson Tait, would administer a full aperient dose, say three ounces, of Mistura sennæ co. In this way decomposing fæces are got rid of, and the intra-peritoneal tension is relieved. He has, however, seen excellent results from the opiate method. There are possibly cases in which one or other of these methods has its own particular value, and experience alone will teach the surgeon when to use the one and when the other. For a full discussion of the merits of each the reader is referred to Mr. Lawson Tait's *Treatise on Diseases of the Ovaries.*

RETENTION OF URINE.

History of the case.—Patients suffering from retention of urine are usually very restless and very urgent in their entreaties for immediate relief. But the surgeon should remember that no case of ruptured bladder has yet been recorded from simple hyperdistension due to stricture, and so, while he sets about the relief of his patient without delay, the case is never so very urgent as not to permit of very deliberate action. He is not, therefore, to rush at the patient at once to try and pass a catheter. He is first to make a very careful enquiry into the history of the case, passing the different causes of retention before his mind and directing his questions accordingly. It is important to find out whether this is the first time retention has supervened; if so, whether the stream was a full one up to date or whether it has been gradually diminishing in size. It will not do simply to ask the patient if he has been "passing water freely" up to date. He will generally say 'Yes' so long as the stream has been a continuous one, though it may have been less than $\frac{1}{32}''$ in thickness, and though it may have taken him half-an hour to relieve his bladder. Very close questioning must therefore be resorted to, and the surgeon should be careful that the patient really understands the questions put to him. This may seem a very unnecessary piece of advice, but it is not so, unfortunately, by any means. Then it will be well to find out whether he has been catheterised before and that recently. If he has been frequently catheterised, there will be the less hesitation in resorting to the catheter at once for his present relief. Urethritis, specific or otherwise, may be present without any appreciable discharge, and if the case is seen at night, may readily be overlooked, if special enquiry in regard to it be not made. The retention may depend on such urethritis, and it would be unwise to force the catheter along an acutely inflamed and swollen urethra, with a good deal of spasm present as well, till some attempt had been made to allay the irritability of the mucous membrane and relax the accompanying spasm.

We shall now consider the treatment of retention according to the cause found to exist. The cases will be considered in the order of frequency of the causes.

Retention from organic stricture of the urethra.—On examination the bladder is found considerably distended and the patient very restless. He admits that although the urine, up till the previous night, passed freely, the stream was only as thick as a fine thread, or, there was no stream, only drops, and that this condition has been in existence for weeks or months. The usual period stated by patients of the poor class is "ten days," but the surgeon must not rest satisfied till the patient has answered his questions with reasonable accuracy. The case is therefore one of organic stricture, and there is possibly some spasm present as well, to which the present complete stoppage of the urine may be due. Surgeons are inclined to make a great deal too much of this spasm. Retention of urine in stricture is only very rarely due to superadded spasm. What does cause the retention is hyperdistension of the bladder inducing paralysis of its muscle by overstretching. This distension generally takes place at night while the patient is asleep, and its gradual increase is thus not perceived till it has attained a degree at which the bladder is unable to contract on its contents. However, spasm *may* be the immediate cause of the retention, and as we have no means of ascertaining certainly whether it is or not, the first thing to do is to give the patient a hot bath (105° F.) keeping him in it till the skin acts freely and he begins to feel faint. In a small number of cases the patient will be able to pass his urine in the bath. If not, he is to be put to bed and kept warm with blankets. A quarter of a grain of morphine may be given hypodermically. In an hour, or sooner, if he desires it, he may again try to make water. If he fail, catheterism must be tried, beginning with a fair-sized gum-elastic instrument and going gradually down the scale till, if possible, one that passes the stricture has been found. Exceedingly few strictures are absolutely impermeable by the smallest sized catheters, so that the surgeon should exercise much patience and take some time over it before he pronounces the case an impassable stricture and resorts to more serious methods. However, there will always be a small proportion of cases in which the surgeon, however skilful, will fail to introduce a catheter. In these cases the bladder must be tapped above the pubes. No elaborate apparatus is required. The ordinary hydrocele trocar does well enough. If the patient is very weak or nervous it is well to anæsthetise him, but this is seldom necessary. The outline of the distended bladder is first carefully ascertained by palpation and percussion. A small incision through the skin only is then made with a tenotomy knife in the middle line, an inch above the pubic bone. The trocar is then quickly plunged into the bladder through this incision taking care to keep the instrument vertical to the surface. The canula is to be pushed well into the bladder, and may be left there for twenty-four or forty-eight hours with impunity.

The method of tapping the bladder through the rectum is nearly obsolete and so will not be referred to further.

Retention from inflammatory stricture.—It is found that the patient suffers from an acute attack of gonorrhœa, that he has had severe pain in passing water for some days, and that the stream became rapidly smaller and micturition more painful till a few hours before he presented himself, when he ceased to be able to micturate at all. The bladder is distended, the meatus urinarius is red and pouting, the whole penis tumid and rather tender, and a drop of pus can possibly be squeezed from the meatus. It may be reasonably presumed also that there is good deal of spasm in the muscles compressing the urethra. In this case there is nothing in the shape of an organic stricture. The passage is simply obliterated by the tumid inflamed mucous membrane, with possibly some muscular spasm in addition.

Treatment is to begin with a prolonged hot bath during which, in a very large number of cases, the patient will be able to pass water. If not, he is to be put to bed, hot fomentations are to be assiduously applied to the perineum and over the bladder, and an enema of starch and opium should be administered. If leeches are available, half-a-dozen or more to the perineum will give relief. The patient's sufferings may be further mitigated by a hypodermic injection of morphine.

The patient should refrain from drinking more than is absolutely necessary for keeping thirst in check. If he drinks in excess the bladder will rapidly distend still more and his distress will be correspondingly aggravated. In a few hours the patient will usually be able to pass water, but if not the irritability of the mucous membrane will have greatly subsided under the treatment, so that a soft medium-sized gum-elastic catheter may be passed with impunity.

Retention from atony of the bladder.—This is seen very commonly in weak, emaciated old men. The patient often complains that for the last twenty-four hours he is always passing his water in small quantities, seldom that he has retention of urine. Hence the necessity for a careful physical examination in this as in every other case. The history having been carefully gone into with the view of ascertaining the probable presence or absence of stricture, and the diagnosis of atony having been arrived at, a catheter may be passed at once. It is in these cases of old relaxed urethræ that one hears so much of spasm at the neck of the bladder as a cause of inability to introduce the catheter, especially if it is a silver one. In such cases of 'spasm' the operator finds he can introduce the catheter as far as the neck of the bladder and no farther. As the patient lies on his back the stem of the instrument remains at right angles with the plane of his body. Now when a silver catheter is in this position, if it is in the urethra at all, its tip is either at the very entrance to the bladder and the slightest pressure or even its own weight will force it completely into the viscus, or, its tip is caught in the floor of the urethra in the loose mucous membrane just outside the meatus internus. It is this pouch that constitutes the so-called 'spasm.' If the catheter is a small silver one, say a No. 5, and its stem be depressed rather roughly while its tip is caught in that pouch, the tip will perforate the wall of the bladder immediately below the meatus internus, and enter the bladder. But instead of depressing the stem of the catheter in this manner, if it be drawn perpendicular upwards in the direction of its own axis for a quarter of an inch and then depressed, its tip, rising from the pouch in the floor of the urethra and presenting directly at the centre of the meatus will slip on into the bladder without difficulty. Sometimes the same may be effected by the help of the forefinger in the rectum.

Retention in paraplegia.—A thoroughly disinfected catheter should be passed at once.

Retention from phimosis.—Slitting or stretching the prepuce or circumcision will relieve this condition.

Retention from urethral calculus.—The calculus is usually found jammed in the external meatus through which it is unable to pass, as this is the narrowest part of the urethral tube. The meatus should be carefully enlarged by a vertical incision and the calculus removed with a forceps. Retention by a calculus arrested at any other part of the urethra can hardly ever occur as an emergency and so will not be alluded to further.

Retention from injury to the urethra by a kick or fall on the perineum.—The retention is seldom complete if the case is seen early. Usually a few drops of bloody urine can still be voided but with great distress. An attempt should at once be made to pass a full size—say No. 10 or 12—silver catheter, keeping the tip of the instrument against the roof of the urethra and guiding it with the forefinger in the rectum. If it can be got into the bladder it should be tied in, and the patient will commonly do well. But if it cannot be got in, the case becomes very serious. No delay should be made in placing the patient under an anæsthetic and trying once more to pass an instrument. If the attempt fail, perineal section should be performed at once and a catheter in this way passed along the injured urethra into the bladder.

If extravasation of urine have already taken place a free incision should be made along the centre of the perineum down to the urethra. The after-treatment of these cases does not concern us here, but the writer cannot help expressing his opinion of the great superiority of dry powdered charcoal over the charcoal poultice so commonly used to suppress the stench inevitable in these cases. The powder can be applied in a thick layer under a light broad dungarry binder, and can be readily removed by the irrigator, and then at once renewed. Extravasation of urine is one of the gravest emergencies the surgeon has to encounter, and from whatever cause arising is always to be treated on the lines indicated above.

Retention from chronic enlargement of the prostate.—Retention from this cause seldom occurs amongst the natives of Southern India.* Chronic enlargement of the prostate is a very rare condition with them. But it occurs frequently enough amongst Europeans in India, and the enlargement may attain very considerable dimensions. Retention from an enlarged prostate occurs mostly, if not always, in old men, and the retention is seldom complete—there is usually a constant dribbling of the urine which keeps the patient miserable. The bladder gets over-distended. The proper instrument to use in these cases is the catheter *coudé*, but an ordinary gum-elastic catheter with a very flexible stilet can be bent to the same shape and introduced without much difficulty usually.

In some cases it is a good plan to pass a catheter with a stilet in it down to the prostate, and then, holding the catheter pretty firmly against the organ, withdraw the stilet, at the same time pushing the catheter very gently onwards into the bladder. The withdrawal of the stilet in this manner causes the tip of the catheter to rise above the prostatic obstacle and find its way into the bladder.

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* Brigade-Surgeon Sibthorpe (now Surgeon-Major-General) informs the writer that he has only seen two cases of chronic enlarged prostate in natives of India. Surgeon-Major Maitland has seen only one or two, but never a case causing retention of urine. Surgeon-Captain Williams records two cases, in one of which he performed partial extirpation of the prostate with success.

If all attempts at catheterism fail, the bladder must be tapped supra-pubically in the manner already described.

Retention from acute inflammatory enlargement of the prostate.—This is common enough in natives of Southern India. As a large gum-elastic catheter can be passed readily enough in these cases, they are very likely to be diagnosed cases of atony of the bladder if the case be not carefully examined. This examination is all the more necessary, as if prostatic abscess be present catheterism with metal instruments is not always unattended with danger. If the operator be at all incautious he may readily push the catheter through the softened prostate into the retrovesical subperitoneal tissue giving rise to a hæmatoma sufficiently extensive to cause the death of the patient.

HOW TO PASS A CATHETER.

Before dismissing this subject of retention of urine it might be useful to say a word in regard to the method of passing a catheter.

It is greatly a matter of 'knack,' and this implies that words alone cannot well convey the secret. The route to the bladder can be learnt in one way only which is as follows:—

The young surgeon should provide himself with two catheters of best quality and finish, and thoroughly clean, of about No. 8 or No. 10 in size; one gum-elastic, the other silver.

Having warmed and oiled the gum-elastic catheter and removed the stilet, he should lie down on his back with his head and shoulders a little raised and his feet drawn up close to his buttocks. His bladder should be moderately full. Taking the catheter very lightly in his right hand he should introduce it into his urethra. It smarts like a heated wire at first, but in a few seconds this sensation passes off. He presses the instrument gradually onwards proceeding about an inch a minute till the tip reaches the bulb of the urethra or probably the beginning of the prostatic portion. He will recognise this point by the fact that the catheter is temporarily arrested and he is seized with a violent desire to pass water. This he must refrain from doing. In half a minute or so more the catheter will move on without further difficulty into the bladder. Just as it enters the bladder the desire to micturate will arise again, and the urine will of course escape through the catheter. The instrument should be withdrawn at once, the operator keeping his thumb on the orifice of the catheter, both to prevent ingress of air and to prevent the urine contained in the catheter from dripping over his person. A double-eyed catheter will, however, always drip a little. A slight burning sensation will remain for a few minutes and is of no consequence.

Two days later the silver catheter may be tried, the operator assuming the supine posture as before. The instrument is to be well warmed and oiled. No force whatever is to be used. The instrument is to be allowed to follow the curve of the urethra of its own accord. The *position of the stem of the instrument as its curve traverses the different parts of the urethra* should be carefully noted and borne in mind when the surgeon next operates on a patient.

During self-catheterism the operator should always lie on his back. If he attempts the process in the erect posture he may grow giddy or even faint away, and, falling, may injure his person very seriously: a silver catheter has been known to be driven in this way through the wall of the urethra into the rectum. In the supine posture no accident can possibly happen.

Once a surgeon has thus learnt the way to the bladder, few further hints will ever be necessary. Patience and a light hand attentive to every movement of the instrument and to every obstacle encountered by it in its course will generally overcome every difficulty not physically insurmountable. But let every young surgeon remember the words of Sir Henry Thomson "I maintain that no man should pass an instrument for another until he has passed one for himself."

RUPTURE OF AN INTERNAL ORGAN.

The only organs for the rupture of which active treatment is advocated are the stomach, the intestines and urinary bladder.

Rupture of stomach or intestines.—In the case of the *stomach* and *intestines*, if the injury can be diagnosed sufficiently early (in penetrating gunshot wounds of the abdomen perforation is always to be presumed) an exploratory operation might be performed and the rent in the bowel stitched up or repaired in whatever way the particular case demanded. The peritoneal cavity at the same time should be carefully washed out with warm water, with or without some antiseptic in solution. Probably it would sometimes be well not to try to close the rent in the bowel, but to bring it up to the abdominal wound and stitch its margins to the edges of the wound in the peritoneum to establish an artificial anus.

Now that resection of the bowel can be rapidly performed by the aid of Murphy's button, this procedure might be desirable in some cases.

Rupture of urinary bladder.—Intra-peritoneal rupture of the *urinary bladder* generally presents no serious difficulties in diagnosis, and an attempt should always be made to close the rent by opening the abdomen, stitching the edges of the wound in the bladder carefully together by fine silk or catgut, and finally washing out the peritoneal cavity and closing the abdominal wound. In cases of multiple injury where the pelvis is involved, extensive injury is sometimes done to the bladder by a ramus of the pubes being driven into the viscus from the front. The urine, of course, immediately escapes into the adjoining tissues as fast as it is secreted, and there is generally pain and tenderness in the hypogastrium. There *is no sure sign* by which such an injury can be diagnosed from an intra-peritoneal rupture, and the rule to be observed in treatment, should the general condition of the patient permit, undoubtedly is, " when in doubt open the abdomen."

INJURIES KNOWN TO BE USUALLY FOLLOWED BY TETANUS.

It is just possible that the remarks which now follow have only a purely local, or, at any rate, a tropical significance. The subject of tetanus in relation to its causes, geographical distribution, and the climatic conditions under which it develops, has received but little attention in India, except in a few of the larger centres such as Madras and Calcutta. A very elaborate analysis of the facts available in this connection was brought before the South Indian Branch of the British Medical Association some time ago.* Of the conclusions arrived at in that paper three bear specially on the subject of this chapter: (1) the seasonal prevalence of the disease—the early part of the hot season, especially the month of May; (2) the variety of injury most likely to be followed by tetanus—contused and lacerated wounds especially of the foot; (3) and all compound comminuted fractures not treated antiseptically. It is possible that it is the greater liability of the foot to be injured by highly septic agencies that accounts for the greater prevalence of tetanus in injuries to it than in injuries to the upper limb.

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* *Vide*. Transactions of South Indian Branch of the British Medical Association " Notes on Tetanus " by Brigade-Surgeon Sibthorpe, F.K.Q.C.P.I.

When tetanus follows an operation within a week or so the wound in the great majority of cases will be found to have turned putrid. No amount of care in the antiseptic cleansing of a contused and lacerated wound of the foot will in all cases prevent tetanus. The infecting micro-organism in these cases seems to be ground into the tissues beyond the power of a bactericide to reach them.

It is in these cases the great difficulty as to treatment, arises. A lad, in the early hot season, has had his foot crushed by a cart-wheel. The skin of the dorsum of the foot is torn off in the form of a ragged flap and is much bruised; so also is the subcutaneous cellular tissue. The tips of a couple of toes are also ground off and probably a phalanx or two dislocated. Such is a typical tetanus-producing case in Madras. Hardly any but the superficial tissues seem injured quite beyond repair. One expects a little superficial sloughing followed by granulation and recovery, with perhaps a little stiffness of one or two joints. But notwithstanding every antiseptic precaution, tetanus sets in in forty-eight hours and carries off the patient.

Amputation, once tetanus has set in, is useless.* Amputation at first would have looked like wanton mutilation, but nevertheless it would seem that it ought to have been done. The fact that tetanus sometimes follows any operation is no argument against operating in cases of injury with the view of preventing tetanus. When tetanus follows operations within the first few days it is clearly through failure to maintain thorough antisepsis in the enormous majority of the cases, if not in all. The wounds always become frightfully septic. But yet the wound was under control. It was not an impossibility to keep it aseptic. But it would be an absolute impossibility to make a wound crushed and torn by a dirty cart-wheel aseptic. One should therefore substitute as quickly as possible a clean cut, aseptic, controllable wound for the lacerated septic uncontrollable one. And so in such cases, occurring at the season indicated, the proper course to adopt seems to be to advise the patient and his friends of all the probabilities of the issue, and leave the responsibility of declining operation on themselves. If they do not consent it will be the surgeon's duty to remove all crushed tissue, irrigate the parts thoroughly with a strong antiseptic lotion, removing all foreign material as far as possible; then apply an antiseptic dressing and place the limb in such a position as will secure the greatest degree of rest. The patient should be kept well protected from chill,* and a dose of santonin and castor-oil at once administered. As a preventive of tetanus, bromide of potassium and chloral may be given regularly throughout the course of the case. These drugs are believed to have some beneficial effect, though it is very doubtful, and their action requires further investigation.

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* *Vide* op. cit.

FOREIGN BODIES IN THE PHARYNX AND ŒSOPHAGUS.

The whole of the space above the level of the *rima glottidis* is accessible to the fore-finger. When, therefore, a case of supposed foreign body in any part of this space presents, careful search should first be instituted to learn the exact site and nature of it, if it be really present. If it can be felt with the finger, it should be removed by the mouth either with the finger or a forceps; no attempt should ever be made to shove it downwards with a probang; *nor should a probang ever be used in any case whatever till a thorough digital search has been carried out*, and the operator feels satisfied that the object if present at all is beyond the reach of the finger. The search with the finger should be carried out in a systematic manner. It is well to examine the right side of the patient's pharynx with the right fore-finger, and the left side with the left fore-finger. The parts should be examined in the following order:—the recess by the side of the base of the tongue, the recess in front of and by the side of the epiglottis, the rough granular area just below the tonsil, the tonsil itself, the sulcus surrounding it, the whole space included between the pillars of the fauces, the side of the pharynx as low as the finger will reach, the posterior wall of the pharynx, finally the mucous folds of the larynx. By this methodical search, the surgeon will not only be less liable to miss the object of his search, but the process will be far less irksome to the patient than the usual aimless sweep of the finger so commonly practised.

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* Brigade-Surgeon Sibthorpe is of opinion that the use of evaporating lotions in such cases predisposes the patient to tetanus, on account of the chill so generally induced during the process.

If the patient is a child or is very irritable, the fauces and walls of the pharynx should be well sprayed three times at intervals of five minutes with a 2 per cent. solution of cocaine before any exploration is attempted.

If the foreign body is of such a nature and in such a position that immediate suffocation is threatened, no precious time should be lost in vain attempts at extracting it—tracheotomy is urgently indicated; after which the search for the foreign body may be resumed.

When the surgeon feels satisfied that the foreign body is in the gullet, he should attempt its removal by means of the laryngeal forceps or by the sponge or horse hair probang, failing which, he has four courses open to him:—(1) to push the foreign body down into the stomach; (2) to perform œsophagotomy for its removal; (3) to give emetics with the view of causing its ejection with the contents of the stomach; and (4) to allow the object to remain where it is till it grows loose by ulceration.

Of these four courses by far the best is œsophagotomy, provided the surgeon has every facility for its performance; the next best is pushing the foreign body into the stomach, which can be done in the enormous majority of cases, but which now and again is impossible owing to the peculiar jagged shape of the object, or to its being small and hooked firmly into the wall of the œsophagus, and then œsophagotomy is the only resource; emetics are recommended by many writers, but condemned by as many more; in the writer's experience the mere tickling of the fauces during digital exploration has frequently caused violent emesis with ejection of the foreign body, and he would therefore be inclined to have resort to emetics after the probang and forceps had failed. To leave a foreign body in the œsophagus deliberately with the view of allowing it to ulcerate itself loose is very gross surgery, but sometimes even an œsophagotomy will fail to secure its removal, and the operator will then be obliged to leave it there; it will produce ulceration and fatal cellulitis almost invariably.

The laryngoscope is of little use in the investigation of cases such as these. The finger will certainly detect any foreign body perceptible by the laryngoscope.

FOREIGN BODIES IN THE LARYNX AND LOWER AIR-PASSAGES.

If the patient is cyanotic and on the verge of suffocation as will be the case now and again, tracheotomy should be performed at once, or laryngo-tracheotomy if the patient be very shortnecked. If the symptoms are not so urgent, the surgeon should proceed with deliberation. He should make careful enquiries as to the time the accident happened, the circumstances under which it occurred, the probable shape and size of the body and the material of which it consists. He should then make a careful digital exploration of the upper passages, and follow up with the laryngoscope, having first carefully cocainised the pharynx. The differential diagnosis of the seat of the foreign body, whether it is above or below the vocal cords, or in the trachea, or in one of the main bronchi, does not concern us here, but it may be well to remark that once the foreign body has passed into the trachea the symptoms are usually much less urgent, and only come on *at intervals* unless the body is impacted in a bronchus when they will be constant and marked, but not very urgent. When the foreign body is in the *larynx* the dyspnœa is usually continuous if present at all, and its degree depends on the size of the object and the degree of irritation its shape produces in the larynx. If it is a small round body the distress may be very slight, if it is half the fruit of a thorn-apple or a piece of jagged tin or a molar tooth, the distress will be intense, producing a degree of exhaustion that must be seen to be realized.

If it is a small round or tolerably smooth heavy body the inversion of the patient not uncommonly causes its dislodgment. In possibly all other cases, "inversion, emetics, sternutatories and other so-called remedies only waste time and distress the patient."—(Moullin).

If the foreign body is in the larynx, after the failure of inversion, and all attempts at extraction by means of forceps guided by the laryngoscope, the parts having been thoroughly cocainised, thyrotomy should be performed. Thyrotomy is infinitely more satisfactory than laryngotomy, and if the operator have been careful to make the incision right in the middle line the wound will heal readily enough without material loss of voice.

If the body be in the trachea, inversion may also be tried, and failing, laryngo-tracheotomy should be performed, the opening being maintained by two small wire retractors which can easily be made for the occasion by bending two pieces of wire into the requisite shape. These retractors should be tied firmly back by a piece of string passing round the neck. The foreign body, not uncommonly, will now be coughed out through the opening, and the patient may be inverted and placed in the prone position to facilitate this event. But if it is not coughed up efforts must be made to remove it by an alligator or other form of tracheal forceps, or by narrow loops of wire. If the foreign body evade all attempts to seize it, the tracheal opening must be maintained, when in all probability, a little later—hours or days--it will be ultimately coughed up. The after-treatment of these cases requires much attention to prevent or mitigate the laryngitis or broncho-pneumonia so very liable to arise as a sequela and end fatally.

SUNSTROKE.

This condition is met with in three distinct varieties, *viz.*; the **syncopal**—or sheer exhaustion from heat; the **asphyxial,** in which the individual is suddenly struck down by the direct rays of the sun; and the **hyperpyrexial,** wherein high fever is a very prominent symptom.

The symptoms in the first variety being those of a deep faint, with cold damp skin and feeble pulse, the patient should be placed in a shady spot on his back, have his clothes well loosened, and his face briskly sprinkled with cold water. A little brandy and water should also be administered, if available. A sniff of ammonia will also be useful, or a draught containing some of the aromatic spirit of ammonia.

In the second variety the symptoms approach those of shock, with rapid onset of asphyxia and apnœa—unconsciousness, cold and dewy surface, feeble pulse. In addition to the treatment recommended in the first variety, mustard plasters to the neck, calves and epigastrium will prove useful. Five grains of calomel should be administered.

In the third or hyperpyrexial form, the skin is dry and burning—often 108° or 110° F. and epileptiform convulsions are commonly present. The temperature of the body must be reduced as rapidly as possible. The patient should be placed in a cool airy place if such be available, and stripped naked. He should then have a wet pack with iced water if possible, and iced water enemata may also be administered. The packs should be renewed every five minutes. A sniff of chloroform will be useful to allay the convulsions if they are excessive (Fayrer). Pouring water from any height upon the body of the patient greatly increases the convulsions. The vessel from which the water is poured should be brought quite close to the patient's body. A constant gentle cold douche to the head applied in this way, is very useful. This packing and douche should be continued till the temperature falls to 100° or 101° F. When this temperature is reached the patient may remain rolled in a wet sheet and carefully covered with a blanket for a few hours. During this time the temperature should be carefully watched. If it rise the pack must be renewed; if it remain at 101° or lower for a few hours, the patient may be clothed dry, and a diaphoretic mixture containing a saline aperient may be administered every four hours till the bowels act freely and the skin perspires. The patient should be kept in a quiet, dark, well ventilated room.

DROWNING.

The following is Dr. Howard's method * of resuscitating the drowned. The great advantage it possesses is, that during the process the operator is certain that he is actually pumping air in and out of the lungs, for the epiglottis is kept well open all the time. Other advantages are that the process can be carried out by one person and that, to begin with, the lungs and stomach are cleared as far as possible from water:—

i. *Instantly* turn the patient face downwards with a large firm roll of clothing under stomach and chest. Place one of his fore-arms under his fore-head so as to keep his mouth off the ground. Press with all your weight two are three times for four or five seconds each time, upon the patient's back, so that the water is pressed out of the lungs and stomach, and flows freely out of the mouth. Then:

ii. Quickly turn the patient's face upwards with roll of clothing under back, just below shoulder blades, and

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* *British Medical Journal,* 1881, Vol. I, p. 963.

make the head hang back as low as possible. Place patient's hands above his head. Kneel with patient's hips between your knees and fix your elbows firmly against your hips. Now—grasping lower part of patient's naked chest squeeze his two sides together, pressing *gradually* forward with all your weight for about three seconds until your mouth is nearly over mouth of patient: then with a push, *suddenly* jerk yourself back. Rest about three seconds;—then begin again repeating these bellows-blowing movements with perfect regularity so that foul air may be pressed out, and pure air be drawn into the lungs, about eight or ten times a minute, *for at least one hour, or until the patient breathes naturally.*

The above directions should be used on the spot, the first instant the patient is taken from the water. Prevent crowding round the patient. Be careful not to interrupt the first short natural breaths. If they be long apart, carefully continue between them the bellows-blowing movement as before. After the breathing is regular, let the patient be rubbed dry, wrapt in warm blankets and take a little hot brandy and water occasionally and then be left to rest and sleep.

SUFFOCATION DURING THE ADMINISTRATION OF CHLOROFORM FOR OPERATIONS.

Death under chloroform from chloroform poisoning is a very rare event in India. Such a case has never occurred so far as the writer has been able to ascertain in the General Hospital, Madras, where chloroform is administered about two thousand times a year. Death under chloroform is caused in the enormous majority of cases by some mechanical obstruction to the respiration. This obstruction is most commonly due to vomited matter, or blood, finding its way down the windpipe, but is also frequently due to the complete closure of the air-way by the falling down of the epiglottis when the patient has become profoundly anæsthetised.*

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* It is not uncommon for Hindu patients to come to the operating table with a *quid* of betel between the gum and the cheek in one side of the mouth. Europeans may have a quid of tabacco in the same position. It is therefore the anæsthetist's duty before administering the anæsthetic to see that the mouth is free from all foreign substances. Artificial teeth should be removed and teeth so loose as liable to fall out should be extracted.

'Prevention is better than cure,' and these causes of obstruction may be absolutely avoided by the very simple precaution of either always administering the chloroform with the patient's head hanging over the end of the table, or with the pillows under his back instead of under his head, so that the latter may fall well back. The former is the better method in operation about the face, the latter does very well for operations elsewhere, but if the respiration is found at all impeded the patient's shoulders should be drawn up to the head of the table so that the head may hang well back—that is, that the neck may be well extended. In some cases it will be necessary to exaggerate this extension by pressing the fore-head backwards and downwards. This position secures an open air-way by keeping the epiglottis well elevated, and the patient breathes through the nostrils. There will be no air-way by the mouth as the tongue falls against the palate. If the patient suffer from polypi in the nose or from some other form of nasal obstruction it will be necessary to pull the tongue well out with a forceps in addition to keeping the head extended; and in order that there may be no delay in doing this *the chloroformist should always ascertain whether the patient can breathe freely through the nostrils before beginning the administration of the anæsthetic. No attempt should ever be made to draw out the tongue with a forceps until the patient's head is in the extended position.* If the operator attempts to pull out the tongue while the patient's head is on the pillow, the depression of the jaw necessary to get the mouth opened will, to a certainty, close the epiglottis if the anæsthesia be at all profound.

If, notwithstanding all these precautions, the patient cease to breathe, it is not a case of mechanical obstruction, but one of *chloroform poisoning*. The patient is, however, in the very best position for the effectual performance of artificial respiration which should be at once resorted to, Sylvester's method being in every way suitable. The surgeon standing at the patient's head must take hold of the arms above the wrists and carry them well over the head, right back as far as they will go. The chest walls will thus be expanded, and air will generally be heard rushing in through the widely open glottis. The arms must now be brought down against the sides of the thorax and hypochondria and pressed against these parts with a force just short of breaking the ribs. The air will thus be driven well out of the lungs, causing a grunting noise in its exit. This process is to be continued at the rate of about 15 to 17 times a minute, till the patient breathes, which he begins to do by gasps. These gasps should be carefully watched, so that the respiratory acts of the operator may be made to fit in with them and thus render them more efficient. These efforts should be persisted in for half an hour or more if natural respiration has not set in before the lapse of that period. The faradic current may at the same time be applied, one pole being pressed deeply into the epigastrium, the other into the neck above the sterno-clavicular articulation, so as to stimulate the diaphragm. It should be applied for a few seconds about ten times a minute. The sponges should be well soaked in a strong solution of common salt.

The application of a hot sponge over the heart and flicking the thorax and abdomen with the corner of a wet towel are also advocated, and may be tried; but whatever else is tried *nothing must interfere with the efficient performance of artificial respiration with the head and neck well extended, and the tongue drawn out in addition, if nasal obstruction be suspected to exist.**

CHAPTER II.

DIRECTIONS FOR THE EMPLOYMENT OF ANTISEPTICS IN SURGICAL PRACTICE.

INTRODUCTORY REMARKS.

Any breach of the surface of the body, whether caused accidentally or by the surgeon's knife, affords a means of entry into the body of organic germs. These organisms, having effected their lodgement in a wound, induce fermentation, resulting in irritation, suppuration, sloughing or gangrene in proportion to the virulence of the fermentation products. Others again penetrate into the tissues of the body, or circulate in the lymph or blood, inducing specific disorders, such as erysipelas or septicæmia. The principal aim of the surgeon in carrying out the treatment of wounds is either to prevent the entry of these organisms into the part, or else to destroy those that have already obtained a lodging there. The substances employed for effecting this purpose are termed *antiseptics*, and surgery carried out on these lines is termed *antiseptic surgery*.

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* For a very able paper bearing on this and kindred topics—*British Medical Journal*, 1888, Vol. II, page 1108.

The main principles to be observed in carrying out antiseptic surgery may be stated to be as follows :—

1. By means of antiseptic dressings, properly applied, to prevent the entry of organisms into the wound.

2. To *cleanse the wound* with antiseptic lotions, whereby the organisms are either destroyed or their growth prevented and fermentation hindered.

3. To provide *free drainage* in order that the discharges may be carried away before they have time to undergo fermentation.

The first principle, if efficiently carried out, is sufficient to prevent fermentation, but the best method is one which combines all three of the above principles.

It must always be borne in mind that scrupulous cleanliness and careful attention to every detail is essential to the success of the antiseptic method. Omission of the smallest detail or any slovenliness or slurring over may result in failure and may *cause the death of the patient.* The life of the patient is in the hands of the surgeon, and a dirty finger-nail or an unpurified sponge may be the bearer of a fatal poison. Cleanliness should be the motto engraven on the heart of every surgeon.

The following pages will be devoted to a description of the various agents employed in the antiseptic treatment of wounds and abscesses, and the methods of employing them :—

Perchloride of mercury is the most powerful and effective antiseptic agent that we possess, and one of the most useful in the treatment of wounds. The objections to its use are the irritant action which it exerts upon the tissues and the injurious effect it produces on surgical instruments. Under ordinary circumstances, and for direct application to wounds, a solution of 1 part in 2,000 of water is used. A solution of twice this strength is employed for the purpose of cleansing the skin prior to operations, and also for purifying accidental wounds. Perchloride of mercury is also employed for impregnating dressings of gauze, wool, wood-wool, saw-dust and lint. Owing to the injurious action which it exerts on surgical instruments, it should never be used for purifying the latter; carbolic acid should be used for that purpose.

Double cyanide of mercury and zinc is a substance introduced by Sir Joseph Lister. It is an extremely powerful antiseptic, and, although irritant when used in the dry state, yet when moistened it is free from irritant properties. It is used in the form of cyanide of mercury gauze.

Carbolic acid is perhaps the most generally useful antiseptic that we possess. A 5 per cent. solution destroys the spores of micro-organisms, and weaker solutions prevent fermentation. Its action on the tissues is somewhat irritant, but not so much so as that of the perchloride of mercury. It should always be used in as pure a form as possible (the No. 1 acid of commerce is the best) and should form a perfectly clear solution. Impure varieties cause much irritation. Besides its use in solution, it is employed for impregnating gauze dressings, catgut ligatures, silk sutures, drainage tubes, &c.

Solutions of carbolic acid in water :—

(*a*) A solution of 1 in 20 is used for purifying the epidermis of the part about to be operated upon; for cleansing instruments and sponges, and for washing accidental wounds. It is also used for purifying the hands of the operator and assistants.

(*b*) A solution of 1 in 40 is used for washing out wounds which are aseptic.

Solutions of carbolic acid in oil:—

(*a*) Solutions of 1 to 5 and 1 to 10 of olive oil are used for dressing wounds or abscesses in the neighbourhood of the rectum, or in cases in which there are many sinuses, and in which it is not possible to destroy all centres of putrefaction. Also for dressing ulcers which are not aseptic.

(*b*) A solution of 1 in 20 of olive oil is used for lubricating instruments.

Salicylic acid is a fairly powerful antiseptic. It prevents fermentation and the growth of micro-organisms, but does not destroy the spores of the latter. It is less irritant than carbolic acid. It is employed in the form of lotion and ointment and for impregnating silk, wool, or jute dressings. The lotion is a saturated watery solution containing about $\frac{1}{3}$ per cent. of the acid. The powder is used for dressing small wounds and the ointment for small wounds and ulcers.

Boric acid is a less powerful antiseptic than perchloride of mercury and carbolic acid, but possesses the advantage of being non-irritant. It is employed in cases where the use of irritant antiseptics is inadvisable, for instance, for flushing the peritoneum and washing out the bladder. For this purpose a lotion of the strength of 1 in 20 mixed with equal parts of warm water should be used. In the form of ointment and boric acid lint it is used for dressing ulcers, and in the form of powder for small wounds. If the wound is rendered aseptic and then covered with a thick layer of boric acid retained by a bandage, it may be left undisturbed for many days or until healing is completed.

Eucalyptol is an antiseptic which prevents fermentation, but does not destroy spores. It is less irritant than carbolic acid, and it is employed in the form of eucalyptus gauze, or it may be used as a spray.

Iodoform is an excellent antiseptic agent. It does not possess the power of destroying septic germs, but it prevents their growth and multiplication, and neutralises the chemical changes to which they give rise. It possesses the very great advantage of being hardly soluble in the discharges from wounds and hence its antiseptic action is maintained for a long time. It is moreover free from irritant properties. It is employed in the form of powder for dusting over the surface of wounds before applying dressings, or dissolved in collodion for painting over wounds of the face. Cotton wool impregnated with iodoform is a useful dressing. Owing to the small bulk of iodoform that requires to be carried, it is a most useful antiseptic for the military surgeon.

Iodine is a powerful antiseptic, destroying spores and arresting fermentation. It is used for cleansing wounds, abscesses or sinuses which are in a septic condition. For this purpose a lotion containing one part of tincture of iodine to 80 parts of water is used.

Chloride of zinc.—A solution containing 40 grains to the ounce of water is used for similar purposes to the iodine lotion, namely, for purifying septic wounds, abscesses and sinuses; also for cleansing the surface of ulcers before applying antiseptic dressings.

ANTISEPTIC DRESSINGS.

The essentials of an antiseptic dressing are as follows:—

(1) It must be prepared with an absorbent material.

(2) It must be charged throughout with an efficient antiseptic.

(3) The antiseptic must be so fixed in the dressing as not to be easily washed out by the discharges.

The following are some of the most important dressings used at the present time:—

Carbolic acid gauze.—This is perhaps the most efficient antiseptic dressing that we at present possess. It consists of muslin charged with carbolic acid which is fixed by means of paraffin and resin. The objections to its use are that the carbolic acid being volatile, the dressing deteriorates when kept for any length of time. In general the gauze is employed in eight layers with a piece of mackintosh between the two outermost layers. In cases where there is not much extent of skin to overlap, as in herniotomy, or other operations about the pubes and groin, sixteen or more layers must be used, and loose pieces must be packed round the wound as well. In cases where there is likely to be much discharge, spare pieces, crumpled up loosely, must be used in addition to the layers. The gauze dressing should overlap the wound at least nine inches in every direction. In the case of the limbs it should surround the whole limb and overlap. A piece of gauze soaked in a 1 to 40 solution of carbolic acid must be applied over the protective before applying the dry gauze dressing.

Cyanide gauze.—It consists of gauze charged with the double cyanide of zinc and mercury and stained with logwood. It is a very valuable dressing.

Wood-wool is a soft material prepared by teasing pinewood into a sort of woolly substance, and charged with perchloride of mercury or any other efficient antiseptic. This substance is used as an absorbent dressing in cases of abscess or after operations of magnitude, when there is a likelihood of there being much discharge.

Saw-dust, charged with an antiseptic and made up with antiseptic gauze into pads of various sizes, is a useful absorbent dressing, easily and cheaply prepared. Rags may be treated in the same way.

Absorbent cotton wool, charged with perchloride of mercury, boric acid, salicylic acid or iodoform make a good absorbent dressing, but inferior to wood-wool. The iodoform wool is the best.

Salicylic silk is an efficient absorbent antiseptic dressing much used by some surgeons. It consists of "silk waste teased and impregnated with 10 per cent. of salicylic acid and a little glycerine." (Martindale and Westcott.)

Lint charged with perchloride of mercury or boric acid is used for dressing small wounds from which no discharge is likely to occur, and in which an absorbent dressing is not required. Boric lint is used for dressing granulating sores resulting from ulcers or wounds.

Protective.—This name is given to any substance which is used in immediate contact with a wound with the view of protecting the latter from the irritant action of the antiseptic dressing, and also for preventing the dressing from adhering to the surface of the wound. Too much importance cannot be attached to the use of 'protective' material, more especially in cases where large raw surfaces exist.

Unless protective is used, the dressings become so incorporated with the wound as to render their subsequent removal not only extremely painful, but also by tearing up the granulations, to cause hæmorrhage and subject the patient to increased risk of septicæmia. 'Lister's protective' consists of oiled silk varnished with copal varnish. Ordinary oiled silk may be used as a substitute. The protective should be just large enough to cover the wound, but not larger. Before use it must be washed in an antiseptic lotion.

Drainage tubes are made of gutta-percha, glass, or of decalcified bone. Gutta-percha tubes are generally used. They vary in diameter from that of a crow-quill to that of the little finger, and are pierced at short intervals by holes, which should be half the diameter of the tube in size. In using the tubes, they must be cut to the exact depth of the wound. The inner end must reach the deepest part of the wound, and the outer end must be flush with the skin. Two pieces of silk ligature must be attached to the edge of the outer end of the tube and knotted at a distance of two inches from it. These threads must be laid straight upon the skin, one at each side of the wound. The outer end of the tube must, if possible, be at the most dependent point of the opening of the wound. If the tube has to be placed obliquely, the outer end must be cut obliquely so as to be perfectly flush with the skin. The tube should not be removed for one or two days unless it be obstructed. In large and deep wounds, three or four small tubes, side by side, are better than one large tube, and may be withdrawn one by one as the discharge lessens. In abscesses, the use of the tube must be continued until the cavity has completely closed, and in wounds it must be used as long as there is any oozing. They should be preserved in glass jars containing 1 in 20 solution of carbolic acid, and the latter must be frequently changed.

Mackintosh is the 'pink hat lining' of commerce. It is employed with a view of preventing the discharge from coming directly through the dressings at a point opposite the wound. By its use, outside the dressings, the discharge is made to diffuse itself, and hence a longer time elapses before the latter reaches the air. When gauze dressing is used, a piece of mackintosh is placed between the two outermost layers of gauze. The piece of mackintosh should be slightly smaller than the gauze, and when more than one dressing is used (called a compound dressing) care must be taken that the mackintosh does not project uncovered in the vicinity of the wound. The same piece of mackintosh may be used over again if carefully washed in a 1 to 20 solution of carbolic acid and as long as it remains waterproof.

Sponges.—Besides the ordinary use of sponges during surgical operations, they may be employed as part of the dressing in cases where a large amount of discharge is looked for. In such cases, having been wrung dry, they are placed immediately over the wound, a piece of protective alone intervening, and then covered over with the dressings. Great care is required in preparing sponges for surgical purposes and for cleaning them both during and after an operation. During operation one or, if possible, two assistants should be detailed to attend to the washing of the sponges.

The directions for preparing sponges for surgical purposes, and for cleansing them during and after operations, are given at the end of this article.

GENERAL DIRECTIONS.

Surgical operations.—The first point to be attended to is the cleansing of the skin, and this should be commenced on the day previous to the operation. If there is any hair on the part, it must first be shaved clean.

The skin is then scrubbed with soap and 1 to 20 carbolic solution. It is next scrubbed with turpentine; after which a piece of cloth soaked in 1 to 40 carbolic solution is applied to the part and fixed by a bandage. This dressing is retained until the operation is about to commence, when it is removed, and the part again carefully scrubbed with 1 to 20 carbolic solution or 1 to 1,000 perchloride of mercury solution.

Before the surgeon commences an operation it is essential that he should personally ascertain that everything likely to be required is in readiness. There should be no running about for articles during the progress of the operation. Method and orderliness must prevail. It may be useful therefore to enumerate those articles that are required during every operation.

A dish containing 1 in 40 carbolic solution, in which are immersed a piece of 'protective' and a large piece of gauze called a 'veil' or 'guard.' The latter is used to throw over the wound should the operation be for any reason interrupted.

A dish containing 1 in 20 carbolic solution for cleansing the hands of the surgeon and assistants.

A suitable antiseptic dressing.

One or two towels wrung out of 1 in 20 solution of carbolic acid.

An instrument tray filled with 1 in 20 carbolic solution.

A sufficient number of prepared sponges in 1 in 20 carbolic solution.

Two dishes for washing the sponges in; one containing warm 'boiled' water, and the other, 1 in 20 carbolic solution.

Drainage tubes, catgut ligatures, sutures of various kinds, bandages, spare dressings, and pins, as well as the various antiseptic lotions, and iodoform contained in a dredger or insuflator.

It is hardly necessary to say that all surgical instruments should be kept scrupulously clean. An hour or two prior to the operation they must be laid out ready for use in a tray containing 1 in 20 carbolic solution. Instrument trays are made of vulcanite, enamelled ironware, or tin. Their corners should be rounded so as to prevent the lodgement of dust or dirt. The whole of each instrument must be completely immersed in the solution, and all forceps, or instruments closing with a catch, should be opened.

All things being in readiness, the surgeon and his assistants must carefully wash their hands and nails by aid of warm water, soap, and nail-brush, and then wash them in 1 in 20 carbolic solution. A piece of mackintosh cloth should be spread over the blanket which covers the patient, and over this again one or two towels, which have been wrung out of a 1 in 20 carbolic solution. On those towels the surgeon may, during the operation, place any instrument or sponge that he wishes temporarily to lay aside. The antiseptic dressing is now removed from the part, and the latter is washed with 1 in 20 carbolic solution. The surgeon may now proceed with the operation.

Arteries are tied with catgut ligatures, and capillary hæmorrhage arrested by means of pressure with sponges, which have been wrung out of antiseptic lotion. Drainage of the wound must next be attended to, tubes being used in the manner already described, or else wisps of horse-hair or pieces of catgut. Suturing of the wound must be carried out with care and precision, so as to bring all the surfaces of the wound, if possible, in coaptation. The best material for sutures is silk, but of late some surgeons have adopted the use of silk-worm gut. In some cases horse-hair sutures are preferable. When there is much tension, 'button sutures' must be used. These consist of flat pieces of lead pierced by a hole in the centre and connected by means of silver wire.

After the sutures have all been applied, the wound is covered with protective, and the dressings applied. Great care must be taken to fix the dressings by bandages in such a manner as to prevent their being at all shifted. Some surgeons fix the edges of the dressings by means of narrow elastic bandages.

Dressings should, as a rule, be changed twenty-four hours after the operation. If, however, any discharge comes through the dressing before this period has elapsed, the latter must be changed at once. This is only likely to occur after opening large abscesses or after very large operations. Further changes of dressings are determined by the condition of the patient and the wound. As long as no discharge comes through the dressings, and as long as the patient remains free from pain or fever, there is no occasion to change the dressings. They should not, however, be left longer than a week. In changing dressings similar precautions must be adopted as were carried out during the operation.

Accidental wounds.—Too much care cannot be bestowed in cleansing accidental wounds. It must be borne in mind that septic germs have probably already entered the wound and must be destroyed, and the future course of the case will depend very largely on the thoroughness with which the wound is purified in the first instance.

The wound must be held open or, if necessary, enlarged. This is especially required in punctured wounds. It must then be thoroughly washed out with a 1 in 20 carbolic solution or 1 in 1,000 perchloride of mercury solution. If much dirt has entered the wound, this must be scrubbed out by means of a nail-brush. When earth or dust has entered the wound, very great care should be used, and in such cases liquid undiluted carbolic acid should be employed. In cases of compound fracture, the whole of the wound, bone and soft tissues must be sponged with undiluted carbolic acid. After this the wound should be treated in a manner similar to an operation case.

If forty-eight hours have elapsed, or the wound has already become septic, stronger measures must be resorted to. The chloride of zinc solution, 40 grains to the ounce, must be used in the first instance and the wound well swabbed. After this it must be irrigated once or twice daily with iodine lotion until the septic condition has been removed.

Abscesses.—The opening of large abscesses, more especially those connected with dead bone, such as psoas and lumbar abscess originating in spinal disease, can only be justified in cases where perfect antiseptic precautions can be ensured. If such cavities once become septic, a fatal termination is inevitable.

In opening abscesses it is necessary to adopt similar precautions as in the case of other operations. There must be a preliminary and thorough cleansing of the skin, of the instruments, and of the operator's hands. The opening should, as a rule, be made in the most dependent position. Under certain circumstances however this rule cannot be carried out. When, for instance, the abscess points in the neighbourhood of the anus, if the opening be made there, micro-organisms would be likely soon to find their way into the abscess cavity, leading to suppuration and delay in healing, if not to graver results. In such cases the opening must be made as far away as possible from the anus or other source of contamination. The cavity of the abscess must be thoroughly emptied, and in chronic abscesses it may be necessary to scrape the walls of the abscess. Efficient drainage is a most important factor in the treatment of abscesses, and several drainage tubes may be required to effect this thoroughly. The directions regarding the use of drainage tubes have already been given. The dressings must comprise a large quantity of absorbent material. Wood-wool, carbolic gauze, or saw-dust bags are the best material for this purpose. A change of dressings may be necessary before the lapse of twenty-four hours.

Excision and removal of dead bone.—In cases where there are sinuses, these must be laid open and scraped, and then treated in the same manner as septic wounds, with chloride of zinc and iodine lotion.

Ulcers.—When once a wound or other breach of surface becomes covered with a layer of granulations, the latter serve to prevent, as a rule, the entry of morbid germs into the system. In spite of this however it is necessary to treat such granulating surfaces antiseptically.

The skin for some distance around the ulcer must first be shaved and purified in the same manner as already described. The surface of the ulcer is then dressed with lint soaked in carbolic oil, 1 to 5. This dressing is changed daily, and in a few days the sepsis will be completely got rid of, when milder dressings may be employed. The ulcer should first be covered with a piece of oil silk which has been washed first in carbolic acid lotion 1 to 20 and then in a saturated solution of boric acid. The protective should slightly overlap the edges of the ulcer. Two or three layers of boric acid lint, soaked in saturated boric acid lotion, are then laid over the protective and over a large area of the skin around and fixed by bandages. When there is much discharge, a few holes may be cut in the protective. The dressings are changed daily, the skin round the ulcer being washed with carbolic acid lotion and the ulcer itself with the boric acid lotion. The skin around the ulcer is shaved once a week. When the ulcer is healing rapidly, it may be dressed with boric acid ointment (half the strength of the pharmacopœial ointment). The above remarks only refer to the dressing of ulcers from the antiseptic point of view, and the accessory treatment, such as rest and elevation of the part, are purposely not alluded to.

Operations on the rectum.—After the wound has been thoroughly cleaned, a piece of cotton wool, thickly dusted with iodoform and twisted into a roll, is inserted.

Skin grafting.—Similar dressings to those used for ulcers are employed.

Operations on the face.—A modification of the ordinary plan of dressing may be necessary in these cases. The ordinary dressings may be difficult to apply or retain, or the wound may communicate with the buccal or nasal cavities, in which case it will be impossible to prevent septic changes taking place. The wound should be plentifully sprinkled with iodoform and then painted with collodion. When there is communication with the mouth or nose, there should, if possible, be frequent use of Condy's lotion, or carbolic acid lotion 1 to 80.

FORMULÆ FOR THE PREPARATION OF ANTISEPTIC LOTIONS AND DIRECTIONS FOR PREPARING DRESSINGS, SPONGES, &c.

Perchloride of mercury lotion, 1 in 2,000.

Perchloride of mercury	grs.	7
Water	oz.	32

Dissolve and add fuchsine solution sufficient to impart a pale pink colour.

Concentrated solution of perchloride of mercury.

Perchloride of mercury	grs.	240
Glycerine	oz.	6
Rectified spirits	oz.	4

One ounce of this solution diluted with five pints of water makes a lotion of the strength of 1 in 2,000.

Carbolic acid lotion, 1 in 20.

Carbolic acid (No. 1) liquid	oz.	1
Water	pint	1

Dissolve.

Boric acid lotion, 1 in 20.

Boric acid	grs.	175
Hot water	oz.	8

Dissolve.

Chloride of zinc lotion.

Chloride of zinc	grs. 800
Distilled water	pint 1

Iodine lotion.

Tincture of iodine	drachm 1
Water	oz. 10

Perchloride of mercury lint.

Perchloride of mercury	1 part.
Glycerine	1 part.
Water	200 parts.

Steep the lint in the solution and hang it up to dry.

Boric acid lint.

Steep lint for ten minutes in a saturated solution of boric acid in boiling water; drain and hang up till dry. It contains about half its weight of boric acid.

Perchloride of mercury wool.

Cotton wool is soaked in a saturated solution of washing soda, squeezed and thoroughly dried. It is then steeped in a solution of perchloride of mercury (1 in 500) squeezed and dried.

It may also be prepared in a similar manner to the perchloride of mercury lint, absorbent cotton wool being substituted for the lint.

Boric acid wool.

Absorbent cotton wool is steeped in a saturated solution of boric acid in boiling water and then thoroughly dried.

Iodoform wool.

Iodoform.	1 part.
Ether	10 parts.

Soak absorbent cotton wool in the solution and then dry.

Carbolised saw dust.

Saw dust (that obtained from dealwood is the best) is boiled in a 5 per cent. solution of carbolic acid and then dried and sewed up in bags of carbolic gauze.

Salicylic acid ointment.

Salicylic acid	1 part.
Petroleum cerate	24 parts.

Mix. (*Martindale and Westcott*).

Instead of petroleum cerate, a mixture of one part of vaseline to two parts of paraffin may be used.

Boric acid ointment.

Boric acid (finely powdered) ...	1 part.
Soft paraffin	4 parts.
Hard paraffin	2 parts.

Melt the paraffins together and sift the boric acid over the surface of the liquid; then stir together until cooled.

Iodoform ointment.

Iodoform	1 part.
Benzoated lard	9 parts.

Melt the lard at a low temperature and add the iodoform and stir together until dissolved and finally cooled.

Oiled silk protective.

Oiled silk coated on both sides with copal varnish and when dry brushed over with—

Dextrin	1 part.
Starch	2 parts.
Carbolic lotion (5 p. c.)	16 parts.

Drainage tubes of decalcified bone.

Surgeon Deakin in the *Indian Medical Gazette* of the 1st October 1880 proposed the use of the long bones of the limbs of poultry and game birds.

"Long bones of the size required are well boiled to rid them of the soft parts. They are then placed for ten hours in a mixture of one part of hydrochloric acid and two parts of water; this renders the bones soft and pliable, almost all the earthy salts being dissolved out so that the ends of the bones can be cut off with a pair of scissors. This having been done, the medullary canal of the shaft should be well cleaned out with a thick wire, or better with a fine rat-tailed file, and the bone tube should then be well boiled in a 5 per cent. watery solution of carbolic acid to which some borax has been added. The tubes should be kept in 5 per cent. carbolic oil."

Chromicised catgut ligature.

Dissolve one part of chromic acid in 4,000 parts of distilled water, and add to the solution 200 parts of pure carbolic acid or absolute phenol. A quantity of catgut equal in weight to the carbolic acid is now introduced into the solution and left to soak for forty-eight hours. At the end of this time it is taken out and dried. It should be kept in 5 per cent. carbolic oil.

The strength of the catgut must be carefully tested before hand. (*Lancet*, February 1881, pp. 201 and 275.)

ALSO

Take 5 parts of catgut and immerse for twelve hours in 1 part of chromic acid and 100 parts of water. At the end of this time take out the catgut, remove excess of liquid with a cloth and place it in 100 parts of sulphurous acid. In twelve hours take out the catgut and dry it. It is kept in the dry state. Before using it place it for 15 minutes in a 5 per cent. carbolic acid lotion. (Martindale and Westcott's Extra Pharmacopœia, 3rd ed., p. 15.)

Carbolised silk.

Melt together nine parts of yellow wax and one part of carbolic acid (solid), and in this mixture steep the silk thread. As the thread is taken out of the mixture, it is drawn through a cloth to remove the superfluous wax.

Carbolised horse-hair sutures.

Horse-hair is boiled in a 5 per cent. solution of carbolic acid and preserved in carbolic oil of similar strength.

The preparation of sponges for surgical purposes.

They must be first soaked in water to remove sand and dirt, and then immersed in water diluted with hydrochloric acid and allowed to remain until all effervescence has ceased, and all minute shells and calcareous sand have been dissolved. Before this can be accomplished it may be necessary to renew the acid several times. They must next be washed in plain water to remove any superfluous acid. If necessary they may be bleached by repeated washings in a solution of binoxalate of potash (60 grains to a pint) in tepid water.

After being rinsed in hot water they should be stored in glass jars containing a 5 per cent. solution of carbolic acid, and the lotion must be changed once a week.

Directions for cleansing sponges during and after operations.

During an operation they should go straight from the wound into water in order that the blood may be rinsed out of them before they are washed in carbolic acid solution and used again.

After an operation they should be at once soaked in warm water, and then for a day or so in a solution of common salt. This should remove the last trace of blood from them, after which they should be well rinsed in warm water and placed in carbolic solution as before.

Sponges, if neglected, retain blood and fluids very freely and become sources of danger to any patient with whom they are used. The greatest care should be taken in carrying out the above directions, and sponges should never be placed in the store bottles or jars, or used except when absolutely clean and pure.

The preparation of artificial sponges.

These sponges are made of woollen thread, or what is termed 'peacock fingering.' This is cut up into lengths of an inch and then placed in a small bag made of carbolised gauze, which is then tied in the shape of a ball. The ball is then washed in boiling water and placed in 1 in 20 carbolic acid solution, which should be frequently changed. These sponges may be cleansed in the ordinary way and used again; or they may be destroyed after use.

Cheap antiseptic dressings.

The subject of cheap antiseptic dressings is an important one. For the purposes of mofussil dispensaries in India dressings must not only be cheap but easily prepared. Perchloride of mercury is fortunately cheap, costing only Rs. 1-8-0 per lb., and an economical and at the same time efficient gauze dressing may be prepared from it. For this purpose the common coarse cloth used for poultices answers admirably and costs less than one anna per yard. The formula of the solution used for charging this cloth is as follows (Raye, *Indian Medical Gazette*, April 1886):—

Perchloride of mercury	20 grains.
Glycerine	500 minims.
Water	78 drachms.

"Seven yards of cloth are soaked in this solution for twelve hours, then wrung out and allowed to dry." (McLeod, *Indian Medical Gazette*, April 1886.)

This dressing will keep for an indefinite period. That portion of the gauze which is placed in contact with the wound must always be moistened in a 1 to 2,000 solution of sublimate lotion. In place of mackintosh, Dr. McLeod recommends the use of 'bamboo paper' which costs 4 annas 8 pies per quire. "It is prepared by rubbing it on both sides with a cloth soaked in boiled linseed oil, removing the excess of oil by pressing it between two clean sheets and then hanging it up to dry." Iodoform costs only Rs. 1–8–0 per lb. and boric acid Re. 1 per lb., and both these substances should be largely utilized.

CHAPTER III.

POST-MORTEM EXAMINATIONS.

Time of Examination.—Examinations of the dead are performed earlier in the tropics than in colder regions, as putrefaction sets in so much earlier, and destroys or obscures the pathological changes. They should always be conducted with privacy, care, as great cleanliness as possible, and with due regard to the feelings of the relatives of the dead.

The necessity for thoroughness in necropsies.—Post-mortem examinations should in all cases be as thorough as possible. Where time is limited, the examiner, while directing his special attention to the organs suspected to be chiefly affected, for example, the brain and spinal cord in cases where nerve symptoms were prominent during life, should conform, as far as possible, to the principles on which post-mortem examinations should always be made. In *medico-legal* cases the examinations should always be complete. The examiner should never allow himself to be hurried. He should if possible get some person to take notes from his dictation as he proceeds with the examination. It is impossible for the examiner to take notes himself during the necropsy, and it is very difficult to be quite accurate, or even approximately so, when the notes are made out from memory half an hour or more subsequently. In *medico-legal* cases a policeman could usually be found who would take the notes in the vernacular, if no other person were available.

Till the examination is complete, it should not satisfy the medical officer to find *one* apparently efficient cause of death. A case occurred some time ago in Bengal, in which the medical officer, finding a penetrating wound of the abdomen, proceeded no further with the examination but certified that this was the cause of death. The accused in this case was accordingly sentenced to death. On appeal and subsequent examination, it was found that death was really due to fracture of the spine, accidentally produced. *The police had made the wound in the abdomen.*

Whether particular organs are normal or abnormal should be distinctly stated. If no reference is made in the report, the examiner gets the credit of having omitted to note the condition of the organ in question. Nowhere is the gift of description more called for than in necroscopical investigation; and small, apparently unessential details often afterwards prove to be of the greatest value. For instance, if we find a scalp wound complicated with a penetrating wound of the skull, we may describe its length, breadth and depth, the condition of the bone beneath, &c.; but if we neglect to give its direction, that is, whether it runs across the head, or antero-posteriorly, or obliquely in one or other of these directions, we omit very important evidence, if the case is one of assault, as to the probable position of deceased's assailant. We are to remember that in *medico-legal* cases we are not only to find the immediate cause of death, we are expected also in many cases to contribute important evidence towards determining the innocence or guilt of an accused person.

The necessity for following a definite plan.—In all necropsies, a definite plan should be followed. We must observe a certain routine in the mode and position of incisions and in the order of the examination, as well to secure the omission of nothing important as to avoid confounding appearances we produce ourselves with those which may have been on the body before we touched it. For example, if we follow a haphazard practice in opening the thorax we may often admit blood into the pleural cavities, and afterwards find a difficulty in determining whether it was there before we opened these cavities or not; we may rupture the spleen, giving exit to a lot of blood into the peritoneal cavity, and then think the rupture was an ante-mortem condition.

The method.—We shall now give a description of the method to be followed in making an ordinary clinical post-mortem examination. At the end of the chapter the regulations laid down by Government for the performance of *medico-legal* examinations will be found; what follows now, like all such descriptions wherever found now-a-days, is based on Virchow's work on Post-mortem Examinations.* The order in which the different parts of the body are examined secures (1) that the cavities of the heart shall not be depleted till they are actually opened with the knife, (2) that the viscera of the thorax and abdomen are not disturbed from the position they occupied at death till they are laid bare before us, and (3) the maximum of cleanliness consistent with thorough work. The instruments ought to be in perfect order. A cranium-holder is of great service in removing the skull, but is not of course essential. It reduces the labour of removing the skull very considerably, and the surgeon who possesses one will have but little hesitation in undertaking the labour (for it is quite a serious thing in this climate), even when there is no particular indication for examining the cranial cavity. The accompanying figure shows the instrument used in the General Hospital, Madras, devised by the writer of this article.†

The examination is divided into—A. THE EXTERNAL EXAMINATION; and B. THE INTERNAL EXAMINATION.

A. THE EXTERNAL EXAMINATION. During this examination the following points are to be noted, and any others also the examiner may think important. The examiner should aim at minuteness of detail rather than conciseness. Conciseness can only be acquired after much experience. Redundancy can be easily corrected; but an omission, once the body is removed, or even before it leaves the table, is often difficult or impossible to supply satisfactorily.

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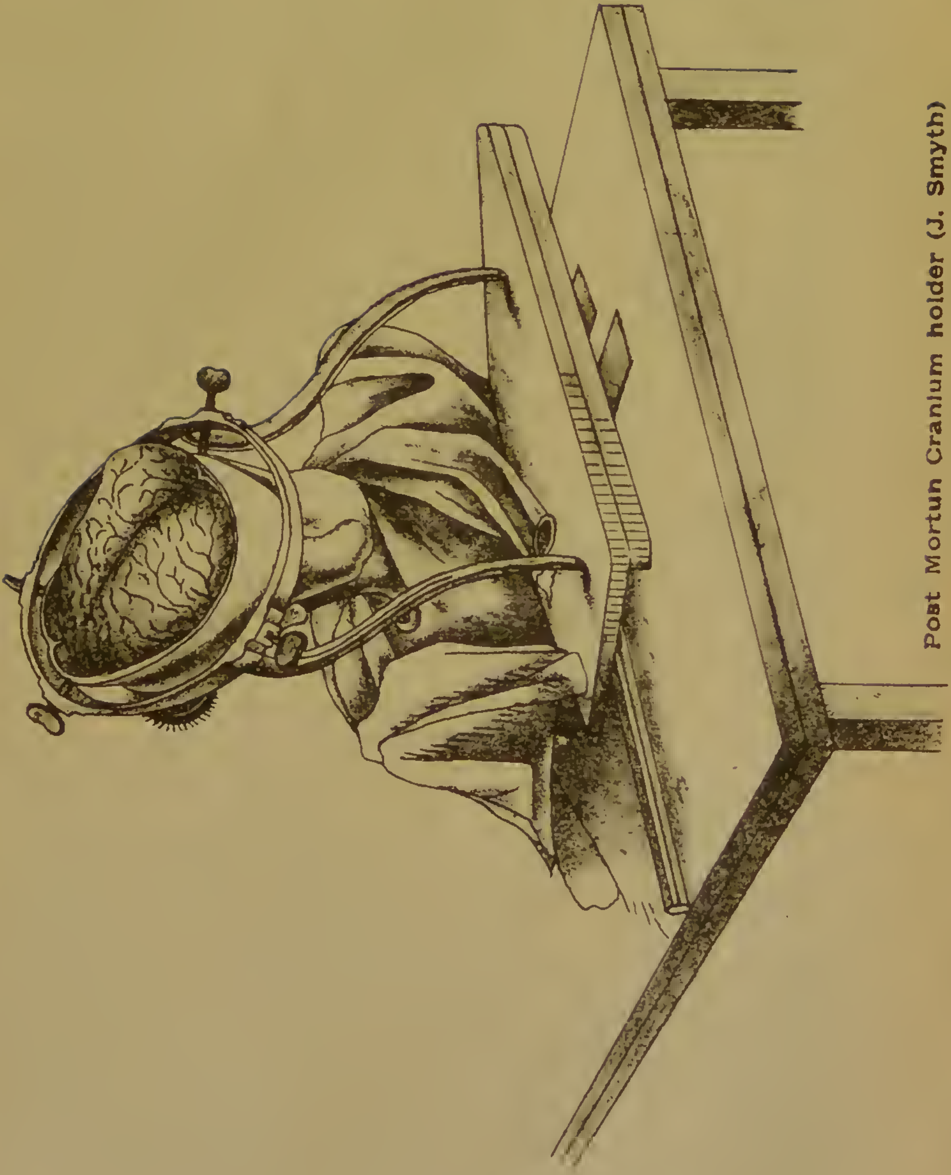
* Translated by Dr. T. P. Smith, 1880.

† *Vide* transactions of this South Indian Branch of the British Medical Association, Vol. III, p. 19.

PLATE VIII



Post Mortun Cranium holder (J. Smyth)

The description is (1) general and (2) particular, beginning at the head and ending with the feet.

(1) **General.**—Having entered the name, race, age (which we are always to estimate by an examination of the teeth, hairy development and general aspect of the body), hour of death, and hour of examination, we proceed to note the height, weight, degree and distribution of *rigor mortis*, post-mortem cutaneous stains, if any ; moles, tattoo marks ; the general nutrition of the body and its muscularity ; also recent operation wounds, noting their condition very minutely ; and, in the fœtus, the presence or absence of *vernix caseosa*.

(2) **Particular.**—(*a*) *Head* and *face :* state of hairy scalp, including colour and amount of hair, the presence of scars or depressions, peculiarities in the shape of cranium if any, the condition of the eyes, whether open or shut, and the state of the corneæ and pupils ; the condition of the nose in regard to freedom or otherwise of the nares from polypi, foreign bodies, ulcers, or any abnormal deviation of the septum ; the mouth, including dentition, the presence or absence of foreign bodies, the state of the tongue and whether it is grasped by the teeth, the condition of the hard and soft palate, pharynx, tonsils, &c. ; the ears, noting any abnormality of shape, congenital or acquired, the presence or absence of foreign bodies, blood, pus or other secretion ; (*b*) *neck* and *submaxillary region :* including the condition of the glands, whether there are scars, or any abnormality of the thyroid body ; (*c*) *trunk and upper extremities :* the shape of the chest, noting specially any difference between the sides, the condition of the mammary and axillary glands, the presence of scars, the hairy development, any abnormalities in the numbers of the digits, the condition of the spinal column, the presence or absence of bed sores and their condition, if present ; the condition of the abdomen in regard to general shape, and in the young infant the state of the umbilical cicatrix, or of the stump of the cord if still present ; (*d*) *generative organs :* the development of hair on the pubes, the condition of the penis, testicle and cord in the male, and of the labia in the female, in regard to deformities, acquired or congenital ; if a child, the descent or non-descent of the testes ; the presence or absence of evidence of venereal disease recent or remote ; (*e*) *the anus :* the presence or absence of feculent or other discharges, piles, prolapse or eczema, and in the infant whether the anus is perforate or imperforate ; (*f*) *lower extremities :* degree of

muscularity, œdema, scars, periosteal affections, especially of tibiæ, shape of feet as to flatness, deformity, abnormal numbers of toes, and the condition of the toe nails and soles.

B. INTERNAL EXAMINATION.—The order of examination here laid down is the best, because the viscera are described as soon as possible after removal from the body, and thus before their colour has altered in any appreciable degree under the action of the air, which causes the more vascular of them after a time to assume a brighter red than they had when first exposed to it. In the General Hospital, Madras, where the examinations are performed by the students themselves, under the guidance of the Pathologist, it is found more convenient to dissect the organs, with the exception of the heart and duodenum, after the whole of them have been removed from the body and placed in order on the table. The condition of the viscera before removal, and their relations, are of course always described as far as possible. To describe each organ as it is removed by the student, who of course would desist from further dissection till the description of the organ had been finished, would absorb a great deal more time than is usually available.

The order of examination.—Virchow teaches that the cavities of the body should be *opened* in the following order : (1) head, (2) abdomen, (3) thorax, because if we open the thorax before the abdomen, the abdominal viscera get displaced upwards; but that the thoracic viscera should be *dissected* before the abdominal, because if we dissect the abdominal viscera first, we cannot help cutting the *vena hepatica* and thus depleting the right side of the heart before we actually see that organ and ascertain its degree of distention by the blood it contained at death. Virchow gives no particular reason for dissecting the head first. We have found, however, in many cases, where the head is dissected before the thorax, that there is a very considerable loss of blood from the veins severed at the base of the skull, causing a hæmorrhage which must deplete the right side of the heart considerably. Consequently, we dissect the brain *after* we have examined the condition of the heart. So that the order we pursue is : (1) to open the abdomen and describe the general appearances and relations of the viscera, as well as the height of the arch of the diaphragm, and the amount of fluid in the peritoneal cavity, if any ; (2) open the thorax by removing the sternum completely, without opening either the pleuræ or the pericardium during that process; (3) dissect the heart, lungs, tongue, pharynx, œsophagus, larynx and trachea; (4) dissect the abdominal viscera and genitals, and finally (5) dissect the brain and cord.

The first incision.—Before proceeding with the internal examination, the operator should rub some turpentine well into his hands, then rinse with cold water, wipe them, and finally oil them thoroughly with carbolized oil. During the dissection, an occasional rinse with cold water, and re-oiling, is a great comfort, and when all is completed he should wash thoroughly with soap and water, rinse with turpentine, and again wash with soap and water. He should stand on the right side of the body as it lies on its back, and grasping the handle of a good long knife, in much the same way as he would a hammer when about to drive a nail, he should make an incision through skin and fat extending from the symphysis menti to the pubes. The blade is not to be pressed heedlessly against the tissues, but is to be held with the object in the operator's mind of cutting a certain depth only. The incision is to be made by the rapid movement of the knife through the tissues, and not by pressing it into them. If the blade really requires pressing to make it cut, it is too blunt for the purposes of dissection.

Having completed the incision down to the muscles, the skin on either side should be dissected back to the trapezius in the neck, the axillary line and flanks on the trunk. The depth of the subcutaneous fatty layer should now be noted, its colour and the presence of abnormal appearances, such as serum, congestion, or blood extravasation; also the colour and development of the muscles.

The opening of the abdomen.—The abdomen is next to be opened by a median incision from the ensiform cartilage to the pubes. The best way is to make an opening very carefully into the peritoneal cavity a little below the ensiform cartilage, and then introduce the index and middle fingers of the left hand with their palmar surface upwards and their points towards the pubes. By separating them a little, and pulling upwards the abdominal wall, the knife can be inserted between them (its handle towards the pubes) and the incision readily completed without injuring any of the viscera. If there is fluid in large quantity present in the peritoneal cavity it will flow away as the incision is being prolonged, and ought to be caught in a vessel by an assistant; for the whole of such fluid is to be carefully measured

The median incision completed, a transverse cut is to be made on either side through the abdominal wall from the umbilicus out to either flank. We have the abdomen now laid open by a crucial incision. This crucial incision is sometimes made without dissecting back the skin. This greatly increases the disfigurement of the body, which should always be a consideration. It is said to save time—probably it does—may be half a minute. The viscera now well exposed, note the amount of fluid, if any, which was found in the peritoneal cavity and its general appearance. If its appearance is very extraordinary we can easily find terms to describe it without making the odious comparisons we not seldom see perpetrated. This remark is to be taken to apply to descriptions of all organs and fluids. We are simply to describe in detail what we see; we are not to dispose of the description of an object of complicated colours and shapes simply by saying it is like such and such; the reader of the report may never have had an opportunity of seeing the object with which the comparison is made, and may never wish to see it. Such comparisons are therefore to be avoided. The relations and appearances of the great omentum, &c., are to be noted just as they lie, and before we disturb them in any way. Then the level of the diaphragm is to be taken by inserting the right hand beneath it and feeling its arch, and making an estimate as to the rib or intercostal space up to the level of which it reaches, estimating the right and left sides separately. We shall sometimes find great differences between the sides, especially if there is an effusion in one of the pleuræ; or even if it be only a pneumonia of one lung, that side of the diaphragm will be a rib or an intercostal space lower than the opposite, if the opposite lung is healthy. Having thus described the first appearances, we can shift the viscera about so as to see if there is anything abnormal in the way of adhesions, displacement, &c., which would otherwise remain concealed.

The opening of the thorax.—The muscular wall of the abdomen is now to be replaced so as to cover the abdominal viscera as well as possible, and we next proceed to open the thorax. This is done by cutting the cartilages close to the sternum above, but more externally lower down, with the cartilage knife, cutting them obliquely and with due caution, otherwise we may readily plunge the knife into the thorax, cutting probably the pleura or pericardium. The pericardium, except it is distended, is not so likely to be injured as the pleura. The first rib will almost always have to be divided by the bone forceps near its sternal end. Finally, we remove the sternum, raising it from below by cutting away the attachments of the abdominal muscles and diaphragm, keeping the edge of the knife always close to its posterior surface. We now take note of the degree of ossification of the costal cartilages, the contents of the anterior mediastinum, fat, tumour, &c., and the condition of the pleuræ and pericardium, whether these exhibit any remarkable fulness or discoloration. The pericardium is next to be opened, taking care not to lose any fluid it may contain and which is to be at once measured and described. Observe also any pathological changes which the pericardium itself may present. The general shape of the heart is to be noted, the degree of fat on its surfaces and its distribution, and the presence of the so-called 'milk spots'; also the consistence of the organ as ascertained by palpation, whether rigid or flabby, empty or distended, the two sides being separately described.

The examination of the heart.—We now examine the contents of the heart.

To do so, certain incisions must be made in definite positions so as to damage the valves and papillæ with their chordæ tendineæ as little as possible. We recommend the student to procure a human heart and carry out the following dissection with the book in front of him. If he attempts the dissection from memory, he will be certain to spoil it. But once accurately done, he will have no difficulties in the future. Virchow's description is so beautifully clear that I shall give it in his own words:

"1. The incision for opening the *right ventricle* must run along the right border of the heart, beginning close to the base; towards the apex the knife must be brought out without going too far down, for otherwise there is considerable risk of cutting the septum.

"2. The incision for the *right auricle* commences half-way between the places of entrance of the venæ cavæ, and ends just in front of the base.

"3. The incision for the *left auricle* begins at the left superior pulmonary vein, and ends in like manner just in front of the base, a point usually indicated by the very prominent coronary vein; we should carefully avoid injuring the coronary vessels.

"4. The incision for the *left ventricle* begins just behind the base and ends short of the apex. It must be carried deeply and forcibly through the wall of the heart."

These incisions made, the cavities are to be evacuated by gentle pressure, one after the other, beginning with the right ventricle. The evacuation is to be carried out by inserting the forefinger through the incisions and gently wiping out the contents of each cavity.

The contents of each cavity should be described separately, noting roughly their amount, colour, degree of coagulation, &c. When using the finger for the purpose of evacuating a cavity, care should be taken not to disturb adherent coagula or growths which may be found on the valves, nor to force it through a stenosed orifice. The examination of the size of the orifices must come later. Virchow says that it may be done at this stage, but in practice it will be found almost impossible to do so. To say that an orifice will admit one or two fingers is to give us about the same amount of information as we would derive from being told that it would admit the proverbial "lump of chalk." We shall frequently find the wall of the heart, especially on the left side, rigidly contracted, or in a state of rigor. This can be overcome by gentle digital pressure both from within and applied externally, care being always taken not to lacerate any structure. The dissipation of the rigidity will materially assist us with the next stage of the dissection which we begin by removing the heart from the thorax. This is done by drawing the apex firmly upwards and forwards so as to exhibit the posterior aspect of the base, and then by a few horizontal cuts severing the venæ cavæ, pulmonary veins, the pulmonary artery, and aorta, keeping well away from the heart. The sizes of those vessels and their contents should be at once noted, and all coagula removed from the cavities of the heart, except rough, old, and very adherent coagula which should be allowed to remain till they have been examined *in situ* after laying open the ventricles properly. The 'water test' may now be applied to the pulmonary and aortic valves after cutting the vessels off within an inch or so of the valve attachments so as to enable us to see the latter properly. Each of these orifices is to be examined separately. The plane of the orifice under examination is to be held in a horizontal position, the heart being supported by gentle pressure of the fingers so as not to affect the size of the orifice; water is then poured into the artery by another person, or from a tap, and the degree of closure of the orifice thus very accurately ascertained. Sometimes in the case of the aortic valve the water escapes from the aorta even when the valve closes properly. In this case the water will have escaped through the coronary arteries which must have been wounded when the left ventricle was opened. (Virchow.) The ventricles are now to be particularly dissected, and the auriculo-ventricular openings thoroughly examined. The 'water test' cannot be satisfactorily applied to the auriculo-ventricular openings, so we must arrive at an opinion as to their ante-mortem efficiency simply by a careful examination of their structure. Here we shall again quote literally from Virchow's work. "The best plan to follow for the purpose of dissecting the ventricles is to place the heart exactly in the position which it occupied in the body, upon a board or table, and then to make the necessary incisions. This has the advantage of exposing to view the directions the incisions are to take. The interior of the heart ought, by means of the following incisions, to be made so far accessible to the eye and finger that the parts remaining to be examined and be conveniently reached. Among these we must mention in the first place the auriculo-ventricular valves with their chordæ tendineæ and musculi papillares, afterwards come the cavities themselves, their endo-cardial investment, the arterial valves, the inter-auricular and inter-ventricular septa, and the muscular substance itself. The incision for the *right ventricle* is in a straight line prolonged from the pulmonary artery and near the base of the heart. The best instrument for this purpose is a long pair of scissors such as those used for examining the intestine. One blade is inserted into the previous incision made in the right border, and carried in a direction towards the pulmonary artery. There is just one thing to bear in mind, and that is, that in this direction we come upon the anterior papillary muscle of the tri-cuspid valve with its chordæ tendineæ; and this must be carefully preserved. If this or its chordæ tendineæ be cut through, we shall not be able subsequently to demonstrate perfectly the arrangement of the valves of the tri-cuspid opening. The blade of the scissors must be introduced in front of the papillary muscle and the incision through the anterior wall of the ventricle and of the pulmonary artery must, as described, be carried close to the base. The incision for the *left-ventricle* which should also be made with a long pair of scissors, is in a straight line prolonged from the ascending aorta, and close to the septum ventriculorum. It commences at the apex of the heart and *divides the anterior wall of the ventricle and of the aorta.* The part which here requires the greatest care and attention is the base of the mitral valve, and the explanation of this is as follows: If we cut directly upwards from the apex of the heart to the aortic orifice keeping too close to the septum, the incision will cross the pulmonary orifice, and by simply continuing the same, we shall cut through the valves of the pulmonary artery. This can be avoided by drawing the pulmonary artery to the right when making the incision, and by continuing this to the left, close to and behind the artery. But we must not go too far to the left. The right border of the base of the mitral valve is inserted quite close to this spot, and this valve is connected immediately with the left border of the aortic orifice. If the incision goes only a line or so too much to the left, we shall cut off that portion of the mitral valve which forms the above named junction and then if we attempt to put together the divided portions of the heart we shall find an aperture in the mitral valve; on the surface of the heart this spot corresponds exactly with right border of the base of the left auricle. This should be our guide. The incision must therefore be carried through midway between the pulmonary orifice and the left auricle.

"To open the *auricles*, cut through their walls between the openings of the venæ cavæ on the right, and of the pulmonary veins on the left side."

We should now note the colour and texture of the cardiac muscle, the thickness of the heart walls in different positions, and the presence of new growths or ulcers if any; the condition of the septa in regard to abnormal openings or persistent fœtal conditions, the degree of hypertrophy or dilatation and its locality; the colour of the endocardium and any new growths, ulcers or other abnormal changes in it; the condition of the valves, in regard to fibroid or atheromatous changes, thickening, shrinking, adhesions or perforations; the condition of the musculi papillaries, and chordæ tendineæ, &c.; the presence of "globular thrombi" entangled in the walls of the auricles or in the trabeculæ near the apex, and the degree in which they encroach (if they do so encroach) upon the cardiac orifices.

We next ascertain the size of each orifice by means of small graduated globes of porcelain or wood, taking care not to overstretch any orifice whether healthy or diseased by inserting too large a globe. Such orifices as have been laid open during the dissection are to be brought together again and globes of appropriate size taken to measure them. Ten different sizes of globes, from $2\frac{1}{2}''$ to $5''$ in circumference, form a useful stock, but several more intermediate graduations would be still better. We now remove every trace of clot of every description and weigh the organ. The heart is too often weighed when undissected and consequently when containing more or less clot; such weighments are, of course, quite worthless.

The pleuræ.—We now open the pleuræ, taking note, if one or other be distended, of the cause of such distension, and we are to measure carefully any contained fluid as well as describe its appearances; also whether the lungs collapse or not, and if not, whether it is because of adhesions, œdema, consolidations, &c.; we note also the exact extent and strength of any pleural adhesions, and the general appearance of the pleural surfaces. All such adhesions are, if possible, to be broken down with the finger, but care must be taken not to injure the lung by violence. Such injury is exceedingly apt to occur in the later stages of grey hepatization. Indeed, an appearance as of abscess is often caused by pushing the fingers recklessly into such softened lung, saturated as it is with puriform exudation. If we find a difficulty in breaking down the adhesions, the best thing to do is to cut away a bit of the corresponding parietal pleura and remove it with the lung. Having freed the lungs all round up to their roots, the latter should be divided close to the lungs, and these organs then removed. If there is a tumour present, aneurismal or otherwise, the preservation of its anatomical relations must be our chief care, and we shall have to modify our procedure in such a way as may seem best for this purpose in each particular case. If it is suspected that such tumour presses seriously on the trachea or its primary divisions, a much more accurate idea of the actual amount of obstruction offered during life to respiration will be obtained by taking a cast of the interior of the tube with plaster of Paris than by merely slitting up the tube and examining it in that way. A cast can be easily taken by first washing out the trachea and bronchi with an alkaline solution, and then with plain water, after which the liquid gypsum may be poured in. It will set in half an hour sufficiently well to allow the tube to be cut away from it by an anterior and posterior longitudinal incision. It is well always to cut a small piece out of the bronchi close to the lung to allow egress of air or moisture before commencing this process; and when it is intended to take a cast, the trachea and lungs should first be removed *en masse* from the body. If no special attention on account of tumour, &c., has been required, we proceed to dissect out the tongue, trachea, œsophagus and thoracic aorta. This is done by passing a rather thin long knife from below upwards behind the symphysis menti, cutting away the fleshy structures from the inner aspect of the lower jaw back to the fauces, and continuing the incisions on either side backwards and inwards to the spinal column, keeping clear of the larynx on either side. By these incisions the superior and posterior attachments of the œsophagus will have been severed, so that by grasping the tongue and drawing it gently forward, at the same time dividing the loose areolar tissue behind the œsophagus with the point of the knife, and dividing the vessels lower down well away from the middle line, the trachea, œsophagus and aorta can be rapidly removed from the body, the œsophagus being ligatured at the diaphragm. During this process the condition of the nerve trunks and vessels exposed ought to be carefully noted. The tonsils, pharynx, tongue, œsophagus, larynx, trachea, bronchi, lungs, bronchial glands and thoracic aorta are to be at once described.

The pathological conditions most commonly found in these organs may be briefly stated as follows: —

Tongue: ulcers, new growths, deformity. *Pharynx:* polypi, adenoid or lymphoid vegetations, abnormalities of the Eustachian orifices. *Tonsils:* enlargement, ulceration. *Fauces:* ulcers, phlegmon, false membranes. *Œsophagus:* stricture, cancer, abnormalities, such as pouches or diverticula, polypi, œdema, ulcers, false membrane, new growths, foreign bodies. *Trachea:* partial closure from pressure which may also lead to perforative ulceration; foreign bodies. *Lungs* (to be weighed before dissection): emphysema, hyperæmia, congestion (which may be hypostatic), œdema, inflammation infarcts, cancer, tubercle, cavities both bronchiectatic and ulcerative, gangrene, foreign bodies, inflammatory conditions of pleural covering. *Thoracic aorta:* Atheroma, true and syphilitic, atheromatous ulcers, calcareous infiltration of atheromatous patches, dilatation, aneurism, abnormalities as to origin of its branches, &c.

This will have completed the thoracic cavity. We must here note that Virchow advises the Surgeon to examine the pleuræ before dissecting the heart, on the ground that if we dissect the heart first we may allow foreign material, *e.g.*, blood, into the pleural cavities. This advice is frequently objectionable (1) because the pleuræ frequently contain large quantities of fluid whose escape would diminish the tension of the blood in the venæ cavæ and allow blood to flow into them from the heart, and (2) because the separation of such pleural adhesions as may exist may give rise to considerable hæmorrhage and thus deplete the heart.

But there are no real grounds for Virchow's fears (1) because when the dissection is properly carried out the pleural cavities are not opened before the heart, and consequently blood cannot enter them during the process of dissecting the heart, and (2) before opening the pleuræ after dissecting the heart, all blood, the result of such dissection is carefully removed by sponging. *If, however, the pleuræ have been accidentally opened during the removal of the sternum, their contents should be at once carefully described and examined, but no attempt to break down pleuritic adhesions should be made till the heart has been dissected.* To examine the nares, the roof of pharynx, and the orifices of the Eustachian tubes, the best method is to cut away the alveolar processes of the upper jaw together with the hard palate by a saw-cut running from before backwards just above the level of the floor of the nares. To expose the jaw for this purpose, the upper lip, cheeks and nose must be liberated from their bony attachments and thrown upwards. The chief abnormalities likely to be found in the region thus exposed are polypi, adenoid vegetations, ulcers, hypertrophy of the lining of the pharynx. Various deviations from the normal in the position of the septa and turbinated bones may also be frequently seen, most of which, however, are quite consistent with the healthy performance of the special functions of these structures.

The abdominal viscera.—The abdominal viscera are next to be examined. In regard to the order in which they are to be examined, we ought to adopt a sequence that would best secure the greatest cleanliness together with efficiency. Keeping this in view we postpone the examination of the intestines to near the end, and also such incisions as would open any considerable vessel. The hepatoduodenal ligament with the portal vessels should be preserved till we are ready to remove the liver, and should be examined before such removal. The examination of the portal vessels is of special importance in cases of hepatic disease, ascites, and intestinal ulceration. We therefore proceed as follows, describing each organ as soon as it is removed:—

1. *Omentum:* cutting it carefully away; abundance of, or poverty in, fatty tissue may be noted, also its position, new growths, or adhesions.

2. *Spleen:* noting its anatomical relations, we remove it; it may be enlarged; softer or harder than normal; altered in colour or consistence; or the seat of new growths. It is to be weighed, measured and incised freely. Having poured water on the cut surface we note the condition of the malpighian bodies and trabeculæ, as well as the consistence of the pulp; also the condition of the capsule, particularly whether it is thickened or not; the presence of cicatrices and infarcts; amyloid disease.*

3. We remove the *kidneys*, first the left and then the right. For this purpose the descending and ascending portions of the colon are to be drawn towards the median line, and the peritoneum with the peri-renal fat in front of each kidney is to be divided carefully in a direction parallel with the long axis of these organs. The remainder of the separation is to be effected by the finger, while the vessels and ureters are to be divided with the knife and not snapped asunder by dragging on the kidneys. The ureter, before division, should be traced with the finger as far towards the bladder as possible and then divided near the brim of the pelvis. The *supra-renal* capsules can easily be removed with the kidneys, and the semi-lunar ganglion examined at this stage also. The kidneys are now to be freed from all fat and weighed.

The chief pathological conditions which may be met with on external examination in connection with the kidneys are: alteration in colour and texture of capsules; surface rough or lobulated; capsule more or less adherent than normal; cysts of different sizes, containing clear fluid, or fluid with sand in addition; the whole organ cystic. The organ should now be divided by a vertical incision running through it from the convex to the concave border. The chief changes which may then be noted are: hyperæmia or anæmia of the tissue, particularly of the malpighian tufts; the cortex may be red, thin and fibrous to the touch, or pale, thickened and slightly soft; hydronephrosis, pyonephrosis, calculi, malignant disease and tubercle; amyloid degeneration; dilation or stricture of the ureters; calculi or other obstruction on or in the ureters; ulcers in calyces, pelvis and ureters.

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* The following solution should be kept ready in the *post-mortem* room to test the tissues for amyloid degeneration: twelve grains of iodine dissolved with twenty grains of iodide of potassium in three ounces of water.

4. In regard to the *supra-renal capsules*, they may be (one or both) indurated, altered in colour or size; and on section, there may be found caseation, albuminoid changes (the latter to be tested for by the iodine solution).

5. The condition of the *semilunar ganglia* ought to be noted here also. They may be the subject of interstitial inflammations and induration, or they may have undergone pigmentary changes.

6. We now open the *bladder in situ*. The naked-eye characters of the urine if there be any, and its amount, should be noted. The chief pathological conditions liable to be met with are thickening or thinning of the wall of the bladder; ulcers, papillomata or other tumours of the mucous surface, sacculation of the interior; calculi; prostatic tumour.

7. In the male, the *bladder* and *penis* should now be removed together. To effect this, the penis and testes should first be decorticated, and then the organs freely cut away from their surroundings, taking care not to cut into the rectum. It is often convenient to cut through the pubic and ischial rami about one and-a-half inch on either side of the symphysis pubis, and remove the portion of bone thus liberated with the generative organs and bladder attached. The testes and their tunics, the cords, urethra and prostate should be carefully examined. The *prostate* is subject to hypertrophy, abscess, tubercle, &c.; the urethra to stricture, calculi, fistula, &c., while the *testes* may be the seat of new growths of various kinds.

8. In the female the same method of examination ought to be carried out. The *hymen* may be present but imperforate; the *vagina* may be the seat of ulceration or fistula, or may contain foreign bodies; the uterus may be

congenitally malformed or may be the seat of tumours, malignant or benign; its lining may be materially altered, or there may be polypi in its interior. Pregnancy, though a physiological condition, should of course be noted, as well as the stage to which it has reached. The *tubes* and *ovaries* may be the seat of inflammatory changes, or of new growths.

9. The *rectum* at this stage may be conveniently cut out, having previously divided it from the sigmoid bowel between two ligatures. It may also be at once described together with the *anus*. Piles, fissure, ulcers, stricture, malignant disease are commonly to be found.

10. The next viscus to be removed is the *liver*, but previously to doing so we must examine the common bile duct. The only proper way to do this is to lay open the duodenum for an inch or two above and below the point of entrance into it of the common bile duct, by an incision running parallel to the axis of the bowel along its anterior wall. For the sake of cleanliness two ligatures should be first passed round the bowel, one above and one below the limit of bowel to be involved in this incision. The ligatures should be applied only as tightly as may be necessary to prevent exit of matter either from the stomach or small bowel. The contents of the portion of the bowel thus opened should be carefully noted; also the appearance of the biliary papilla, and whether on gentle pressure on the gall bladder the bile flows freely into the duodenum. Tiny flukes are sometimes found in the bile and should be preserved, as they are very rare in South India.* The characters of the bile should also be stated. The state of the lining of the exposed bowel should receive minute attention, particularly if such changes as may be present affect the orifice of the common bile duct. If we have any reason to suspect pathological changes in the *vena portæ*, now is the time to make our investigation. Such investigation will be very difficult or impossible if we postpone it till after the liver has been removed.

These matters having been attended to, the *liver* is to be removed, noting any adhesions that may exist, their extent and probable duration. The organ is then weighed and measured, the colour and any alterations in general outline noted, also its consistence as ascertained by palpation; and then sections running transversely through it are to be made. The slices thus produced are to be left attached to each other posteriorly by the capsule and a thin layer of hepatic tissue, so as to enable the dissector to replace the parts accurately, should he desire to do so at any subsequent stage of the examination.

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* Found only once in the General Hospital, Madras, and that by the writer. *Vide* post-mortem records of that institution.

Among the pathological conditions we are likely to meet with in the liver are: alterations in consistence, in the direction of increased friability or increased toughness (cirrhosis); the condition known as 'nutmeg liver,' produced by chronic congestion of the hepatic vein radicles; thickened and adherent capsule, or a capsule thin and too easily separable; abscesses (their situation, number, contents, and condition of their walls being noted); gummata and the cicatrices produced by them; fatty and amyloid degeneration; hydatid disease; cancer.

11. The *pancreas* can now be easily removed. Of all the organs in the body it is the least liable to obvious pathological change. The only disease we are likely to find it the subject of is cancer, and even this is rare as a primary condition.

12. The general appearances of the *stomach*, *intestines*, *mesentery* and *mesenteric glands* are now to be examined.

Removal and examination of intestines.—The intestines are to be removed beginning with the small bowel. This bowel is to be divided between double ligatures about four inches from its cæcal end, and cut away from its mesentery by an incision running close along the wall of the bowel. If any appreciable amount of mesentery is left attached to the bowel, the latter cannot be straightened out properly for examination, nor can the incision which is to lay open the bowel, and which is to run along the mesenteric attachment be at all conveniently made. Having liberated the bowel as high as the duodenum, it is to be again divided between double ligatures and removed to the trough for examination. It is to be carefully opened as just described by a bowel scissors. It would doubtless be a more delicate process were we to wash out the bowel by a stream of water before opening it, but if we do so we may lose much valuable information as to the presence, numbers, variety, and situation of parasites, the seat of impacted fæcal matter, the exact condition of such ulcers as may be present, and we may even rupture the bowel at the seat of a very deep ulcer by a too high water pressure; and in regard to the exact nature of the contents of the bowel in general. Having opened the bowel, and carefully described its contents as we proceeded with the incision, we ought then to subject its mucous coat to a stream of water so as to enable us to examine the mucous membrane more particularly, and the different varieties of glands peculiar to the different portions of its extent.

The chief pathological conditions we may find, including those of the duodenum, which also is to be now fully examined, are:—*Parasites*—of these the principal are ascaris lumbricoides and anchylostomum duodenale, but in the case of the latter it is rare to find any but dead ones lower down than the jejunum, or even than the duodenum. Dead ones may be found anywhere throughout the whole intestinal tract. The ascaris may be found alive anywhere along the intestinal tract, but is commonly found in this bowel, particularly in the jejunum. It may be found also in the common bile duct, gall bladder, in the substance of the liver, or in the substance of the mesentery into which it has wriggled itself through an ulcer situated over the mesenteric attachment. *Inflammation* (degree and extent to be noted). *Ulcers:* it is better first to describe the ulcers in a general way as to situation and extent, and then describe a typical specimen of those present, than to say that they belong to one or other variety commonly met with in this situation. After the description the type to which we believe they belong may be inserted in brackets. These types are the typhoid, tubercular, dysenteric, and one described by Carter of Bombay, which we may call *ulcus Carteri*. *Cicatrices* should also be noted if present, and whether they have produced any narrowing of the lumen of the bowel; any perforations should be carefully noted. *Tumours:* cancer is the chief, and the duodenum is its favourite seat. *Diverticula:* if there is a diverticulum the umbilical area of the peritoneal surface of the anterior wall of the abdomen should be carefully examined.

We now remove the *colon*, noting the development of the meso-colon in the different sections of the bowel and the exact relations of the *appendix vermiformis*. The same points noted for attention in the case of the small bowel are to be alluded to here also, *viz.*, inflammation, ulceration, stricture, parasites, new growths, &c. The commonest parasites found are the trichocephalus dispar in the cæcum (nearly always present); tænia, and oxyuris vermicularis; the commonest ulcers are the dysenteric and fæcal; in addition, we are to note carefully the condition of the ileo-cæcal valve and vermiform appendix, the latter especially in all cases of peritonitis; intussusception most commonly occurs through this valve.

The *stomach* is next removed, noting any abnormalities in the shape of peritoneal adhesions that may exist. Its contents are to be measured and described; also the state of its walls in regard to inflammation, thickening, ulcers, new growths; and the degree of pigmentation.

We should now examine the retro-peritoneal lymphatic glands, the receptaculum chyli, cœliac axis, abdominal aorta and its primary divisions, and finally the inferior vena cava.

Such is a general outline of the dissection of the abdominal viscera. There will be found, however, many cases where this order of examination cannot be followed, *e.g.*, in cases of intestinal obstruction, tumour, &c.; in such cases the surgeon must be guided by common sense, ordering his procedure as may seem best calculated to display the conditions present. In cases of obstruction it is good practice to try to discover the nature of the lesion and to effect its reduction after the manner of a regular surgical operation for that purpose.

13. The *brain* and *spinal cord* are now to receive our attention. The former is to be removed from the cranial cavity, while the body still lies on its back, the latter afterwards when the body has been turned on its face.

Removal of the brain.—The first step is to make an incision extending from ear to ear over the vertex of the skull. In making this incision the back of the knife is to be kept towards the bone, and the cutting done by thrusting the point of the blade into the subcutaneous tissues and cutting outwards. The edge of the knife is thus preserved and we cut away but little hair. The flaps thus formed are now dissected away from the bone as far as the eyebrows in front, and the occipital protuberance behind. We next apply the cranium-holder (*vide* page 272), allowing as much of the skull to protrude through it as is consistent with its holding a good grip. The line of the intended saw-cut is to be marked out with the knife so as to lay bare the bone through its whole extent. In ordinary cases, the outer table of the skull only is to be divided with the saw, the inner to be fractured by a chisel and hammer, taking care not to drive the chisel against dura mater, or injure that structure in any way. If, however, we are dealing with a case of fracture of the skull, both tables should be divided with the saw. If we use the chisel we are pretty certain to extend the already existing fracture and thus greatly exaggerate the injury.

Having divided the skull thoroughly, the calvarium is to be removed by gentle traction, when, if there be no abnormal adhesions, and the body be an adult, it will come away easily. If there be any marked adhesions, or if the body be that of a child, in whom the adhesion between dura and bone is always marked, we had better not attempt to separate the bone from the dura mater, but cut the latter with the scissors along the line of the division in the bone, and, having divided the attachment of the falx cerebri to the crista galli, remove it with the calvarium. Any fluid which escapes during this process should be carefully noted and an estimate made of its amount. The first drops that escape should be especially noted, for they will be of the exact description of what really existed in the subdural space before we opened it; what subsequently escapes is always blood-tinged from commingling with the blood which escapes from the divided vessels of the dura mater.

The condition of the calvarium should be noted: anything unusual in regard to its thickness or the presence of syphilitic disease, or fractures; also the state of the frontal sinuses, if they have been opened. In removing the *dura mater* any alterations such as discoloration, thickening, calcareous or bony deposit, or any adhesion to the arachnoid should be noted; also the state of the pacchionian bodies. Where adhesions exist, they will usually be found along the margins of the great fissure, and large vessels not uncommonly exist in them. The longitudinal sinuses ought to be laid open now, and carefully examined.

The next step is to remove the brain, and this will be facilitated by allowing the head to hang over the edge of the table, carefully supporting the brain with the left hand so as to prevent any undue tension on the cranial nerves as they pass through the foramina in the basis cranii. With the head in this extended position the frontal lobes easily fall away from their bed and the olfactory bulbs come at once to view as they lie upon the cribriform plate of the ethmoid, from which they are to be gently detached with the handle of the knife; then the optic nerves and internal carotid arteries are to be divided close to the bone, and the pituitary body is to be raised out of its fossa. The third, fourth and sixth nerves are next divided, and then the tentorium, with the fifth, seventh and eighth nerves. The incision through the tentorium is to be carried close to the petrous portions of the temporal bone. The remaining cranial nerves are next cut across, and finally, passing the blade with its edge looking inwards and forwards into the spinal canal, we divide the cord as low down as possible. The brain will now fall easily away, supported by the left hand.

Our next duty is to examine the basal dura mater carefully. The brain meantime should be set aside in a dish, supported round about by a towel twisted into a roll. Its examination is to be completed as soon as possible. The following description of the procedure to be observed in so doing is taken almost *verbatim* from Dr. Woodhead's work on Practical Pathology, and is a condensation from the writings of Virchow with but slight modification.

Weigh *the brain*, then dissect it. In making this dissection it is necessary (as in dissecting all the viscera) to have two ends in view; first, to make as complete a naked-eye examination as possible; second, to have the organ so cut up that it will be possible to replace each separate part in its proper position to enable the operator to examine the organ as a whole, or to take any small portion from a precise given area with certainty. These ends may be attained in one of several ways. Virchow's method is the best for our purposes and, slightly modified, is as follows:—With a long, thin, narrow bladed knife cut horizontally from within outwards into one hemisphere, just above the level of the corpus callosum, leaving the upper part of the hemisphere attached to the lower by the pia mater only, at its outer margin; make a similar incision into the opposite hemisphere. Then examine the lateral ventricles before any excess of fluid has time to escape, by cutting vertically down into the corpus callosum at a distance of one-sixteenth of an inch from the mesial plane, until at a depth of one-eighth of an inch the knife comes directly into the lateral ventricle. This incision is to be extended both backwards and forwards for some distance in order to expose the floor of the ventricular cavity (note the quantity of fluid that escapes). Then divide and sub-divide several times the upper potions of the cerebral hemispheres already turned outward. Here, again, always cut from within outwards, and leave the pia mater intact to hold together the wedge-shaped lamellae. To open into the anterior horn of the ventricle cut horizontally into the frontal lobe a little below the level of the body of the cavity, removing the brain substance above the incision. The posterior horn is opened into in a similar fashion, the horizontal incision, however, being made in a plane about three-quarters of an inch lower.

Now separate the pons, medulla, and cerebellum from the brain proper by cutting towards the mesial line in a plane the anterior border of which is just in front of the pons, the other border lying immediately behind the posterior pair of the corpora quadrigemina (testes). A similar incision is made from the opposite side, when the cerebellum, &c., may be removed, and examined later.

Having determined the contents of the lateral ventricles the state of their walls and venous plexus, and the condition of the septum, the latter is taken hold of with the left hand close behind the foramen of Munro, the knife is pushed in front of the fingers through this aperture and the corpus callosum cut through obliquely, upwards and forwards, when all these parts (corpus callosum, septum lucidum and fornix) are carefully detached from the velum interpositum and choroid plexus. After these two latter have been exposed, we have to examine the state of their vessels and tissue. Then the handle of the scalpel is passed from the front under the velum, which is thus detached from the pineal body and corpora quadrigemina, the state of these parts is determined, and the third ventricle exposed.

Then open into the aqueduct of sylvius by making a vertical incision through the corpora quadrigemina. The corpora striata and optic thalami are further examined by means of numerous incisions whose common starting point is the peduncle of the cerebrum. However great the number of these incisions may be—and it is necessary here to make numerous cuts—the relationship of the parts may always be closely preserved in consequence of the connection between each separate portion and the peduncle of the cerebrum.

Cut through the peduncles of the cerebellum, and then make free radiating incisions through the organ so as to expose its internal structure thoroughly.

Treat the pons and medulla in the same manner, but by transverse incisions a quarter or one-eighth of an inch apart, the pia mater on the anterior aspect being left intact so as to keep the parts in proper relation to each other.

Such is a description of a dissection of the brain for pathological purposes. It must be noted, however, that we cannot always, if we would thoroughly investigate several of the commoner lesions found in the brain, such as softening and tumour, carry out this process in the fresh brain—the organ in fact must in these cases be hardened first, by immersion for days or weeks in spirit. Indeed, some pathologists say we should always harden the brain before dissecting it. But this advice cannot be recommended, at least till we have made a few incisions into the diseased parts, otherwise we shall lose much information in regard to the colour and consistence of the diseased parts, and, in the case of gummata at any rate, the spirit so alters their colour that if we have not taken notice of their position before putting the brain into the spirit we may easily overlook their presence altogether when making the subsequent dissection. We should be very careful to see that during the hardening process no undue pressure is permitted on any part of the brain whereby it may be put out of shape. If we neglect this we shall find it all but impossible, afterwards, to determine precisely the exact anatomical relations of any particular lesion.

Amongst the lesions to be met with in the brain may be mentioned, softening, malformation, hæmorrhages, and tumour, in great variety, while the membranes may be the seat of acute inflammation, new growths or pachymeningitis.

The body is now to be turned, with the view of examining the spine, spinal cord and membranes. The process as recommended by Virchow is given here in full. It will bear no condensation.

"The skin and subcutaneous fat are first to be divided exactly over the spinous processes; the muscles are then to be removed from the sides of the latter, and from the arches of the vertebræ. Then by means of a chisel, or a vertebral saw, if at hand, the spinous processes, together with the adjoining portions of the vertebral arches, are to be detached and removed.

The dura mater is now exposed, and after its external surface has been examined, it is to be carefully slit open longitudinally, and the presence of any serum or extravasated blood, or other abnormal matters, is to be determined.

The colour, appearance and general condition of the posterior portion of the pia mater are next to be noticed, and the resistance to pressure of the spinal cord is to be ascertained by gently passing the finger over it.

The roots of the nerves are next to be divided on both sides by a longitudinal incision ; the lower end of the cord is to be carefully taken out, its anterior connections are next to be gradually separated, and finally, the superior extremity is to be removed from the occipital foramen.

In carrying out these directions great care must be taken that the cord is neither pressed nor bent. When removed, the condition of the pia mater on the anterior aspect is first to be examined ; then the size and colour (external) of the spinal cord are to be noted ; and lastly numerous transverse incisions are to be made with a very sharp and thin knife, to determine the internal condition of the cord, both of its white strands and of its grey substance. The dura mater is next to be removed from the bodies of the vertebræ, and the dissector is to examine for extravasation of blood, injuries, or alterations in the bones or intervertebral cartilages."

We have now completed the examination of viscera and the three great cavities of the body observing a particular sequence in the different steps for that purpose. It takes about three hours to perform a complete examination such as we have described, and is no child's play in a climate such as ours. Nevertheless it must be done, and done too by the responsible person with his own hands, especially in medico-legal cases. It is unscientific, as it is criminal and disgraceful for a medical man, whatever his status, who has this duty to perform to hand over the work to toties or other menials, and then come in and take such notes as he can from the mangled remains before him, and possibly afterwards give evidence as an expert in the case.

We here insert a table of weights and measures as an *aide memoire* to the student.

Average weight and measurements of healthy viscera.

I. EUROPEANS (*Gray*).

Brain.—Weight, male 49½ oz., female 44 oz.

Spinal cord.—Weight 1½ oz. Length 16 or 17 inches.

Heart.—Weight, male 10 to 12 oz.; female 8 to 10 oz. Measurement 5 inches long, 3½ inches broad in broadest part, 2½ inches thick.

Lungs.—Weight, right 23 oz., left 19 oz.; less in female. Varies much according to the amount of blood or serum the organ may contain.

Liver.—Weight 3 to 4 lb. Measurement, 10 to 12 inches transverse, 6 to 7 inches antero-posterior, 3 inches thick at back part of right lobe.

Pancreas.— 3 oz.

Spleen.—Weight 7 oz. Measurement, adult 5 inches long, 3 or 4 inches broad, 1½ inches thick. Size and weight vary according to individual age and condition; decreased in old age, increased during and after digestion; large in highly fed, small in starved subjects.

Kidneys.—Weight, male 4½ to 6 oz.; female 4 to 5½ oz. Left heavier than right by about 2 drachms. Measurement 4 inches long, 2 inches broad, 1 inch thick. Supra-renal capsules 1 to 2 drachms.

Testes.—6 to 8 drachms.

Uterus.—1 to 1½ oz.

II. Hindoo Males. Weights only in ounces.[*]

Brain, 44·78; *heart*, 7·8; *lungs*, right 15·3, left 14·1; *liver*, 42·8; *spleen*, 5·8; *kidneys*, right 4·4, left 4·3.

The weight of the heart is probably too high, as it was impossible in many cases to determine whether the necroscopist had freed the heart thoroughly from all clots before weighing.

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[*] These figures were compiled by the writer from the *post-mortem* records of the General Hospital, Madras, from 1872 till 1888 inclusive. Only healthy organs were selected, and these from cases in which the organs selected were not likely to have suffered materially from the disease which proved fatal to the patient. For example, no organ was selected from cases where emaciation was present, or where the patient died of serious heart disease or from wasting disease of any organ. For weights and measures in the famine stricken *vide* 'Famine Diseases,' by Brigade-Surgeon Porter, M.D., F.R.C.S.I.

III. WEIGHT OF BODY.

The following table shows normal weight in proportion to height in Europeans:—

Exact Stature.		Mean Weight.				Weight increased by 7 per cent.			
Feet.	Inches.	st.	lb.		lb.	st.	lb.		lb.
5	1	8	8	or	120	9	2	or	128
5	2	9	0	or	126	9	9	or	135
5	3	9	7	or	133	10	2	or	142
5	4	9	13	or	139	10	9	or	149
5	5	10	2	or	142	10	12	or	152
5	6	10	5	or	145	11	1	or	155
5	7	10	8	or	148	11	4	or	158
5	8	11	1	or	155	11	12	or	166
5	9	11	8	or	162	12	5	or	173
5	10	12	1	or	169	12	13	or	181
5	11	12	6	or	174	13	4	or	186
6	0	12	10	or	178	13	8	or	190

This reads: a man of 5 feet 8 inches should weigh, in his clothes, 11 st. 1 lb.; he may exceed this by 7 per cent. (to 11 st. 12 lb.) without affecting his vital capacity; beyond this amount his respiration becomes diminished. The average weight of the clothes at different ages is 1-18th of total weight of the male body, and 1-24th of that of the female. —(*Quetelet*).

RULES FOR CONDUCTING MEDICO-LEGAL POST-MORTEM EXAMINATIONS AND FOR EXAMINING WOUNDED PERSONS.*

I. The medical officer shall, immediately on receiving from any person, for examination, a corpse or any other substance, inquire and note down the name and residence of such person, and, if he be a police officer, his number and rank, and shall, without delay, grant to such person a receipt for the corpse, or other substance delivered by him. The receipt so granted shall contain a list of the articles or substances received by the medical officer, and the names of the person from whom they were received, and to whom the receipt is given. It shall be the duty of the medical officer to examine all bodies sent to him as soon as practicable after arrival.

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* Departmental Circular No. 2 of 24th January 1884. The Madras reader may consult with advantage Circulars Nos. 6 and 15 of 7th April and 7th September 1892, respectively, issued by the Surgeon-General with the Government of Madras. Memorandum No. 6143 of 6th October 1893 also deals with this matter.

II. In cases where the body is sent to him, the medical officer should note the time of its arrival; the date and hour of the *post-mortem* examination; the sex and height and apparent age of the deceased; the state of the body, whether well nourished or otherwise; the existence or absence of any caste or other marks not of recent origin, such as cicatrices, deformities and the like; and whether the marks upon it correspond with those in the police or other report.

III. In cases where he has been taken to the place where the body lies, besides the above, he should note the place and nature of the soil (if out in the open country) where he found the body, also its position and the state of the clothes, if any. He should also note, in cases of death from violence, the position of the body in reference to surrounding objects, such as sharp stones and the like, contact with which, it may be alleged, has produced the injury; also whether any blood stains are visible on such objects or anywhere near the corpse, and whether any weapons are lying near it. In cases of suspected death from poisoning, he should note whether any appearance, as if of vomited matters, &c., is present in the neighbourhood of the body.

IV. In every case he should describe the condition in which he found the body, noting the degree of coldness, warmth, rigidity and putrefaction, and the amount and nature of the clothing or covering on it.

V. Commencing at the skull and terminating at the feet, he should examine the bones to determine whether any of them are fractured or dislocated, and inspect the vertebral column throughout; also the teeth, hair, orifices of the body and general surface, and also note the state of the pupils, whether contracted or otherwise, and whether any substances are grasped in the hands.

VI. If there be any wound or contusion on the body, he should describe its position, length and breadth. He should note the depth and direction of all wounds, whether there are any cuts on the clothes corresponding to them, and examine the wounds carefully for the presence of foreign bodies, preserving such as are found. He should also state whether, in his opinion, the wound was mortal, giving his reasons for such opinion, and he should be specially careful to examine the neck for marks of compression.

VII. He should also state his opinion as to whether the wounds, if any, could have been self-inflicted, or whether they might have been the result of accident, giving reasons for his opinion.

VIII. He should carefully examine any gun, sword, blood-stained instrument, stick, or stone, by which the wounds may have been inflicted, and mark such instrument so as to be able to recognize it if asked to do so. He should also compare the weapon with the wound, alleged to have been caused by it, and state whether, in his opinion, it was possible for the wound to have been produced by it.

IX. He should commence his dissection of the body by removing the top of the skull in the usual way with a saw, and note anything that may appear unusual.

X. He should then make an incision from the chin down to the pubes, so as to be able to examine the wind-pipe, heart, lungs, liver, stomach, spleen, kidney, and intestines, also the urinary bladder, and note whether any of these organs appear diseased and whether any wound on the outside of the body communicates with the contents of the chest or abdomen.

XI. In making his examination he should disturb, as little as possible, any organ which may communicate with an external wound, if he had reason to think that the body may be re-examined by another medical man.

XII. In the case of females, he should examine the ovaries and uterus, bearing in mind that abortion is sometimes caused by the introduction into the uterus of pointed instruments which may cause death. He should note the presence or absence of pregnancy, the probable period to which pregnancy had advanced, and examine the external generative organs for marks of violence.

XIII. In the case of infants, he should note the condition of the umbilicus and cord, if any of the latter remain. He should also remove the lungs, and try whether they sink or float in water.

XIV. In cases of suspected poisoning, he should not neglect to examine every organ of the body and should pay special attention to the rules laid down with reference to the duties of the Chemical Examiner.

XV. He should bear in mind that death may possibly have been the result of starvation, exposure to cold or heat, smothering, drowning, lightning, strangulation, poisoning, or disease, and state whether death was due to any of these causes, giving his reason.

XVI. He should keep all his original notes even though he may make a fair copy of them afterwards, and should not lend them to any one to read.

XVII. In all cases the examination of the body should be thorough and the notes of the appearances discovered should be as minute as possible.

XVIII. Full notes should also be made in cases of examination of wounded persons.

XIX. When summoned to give evidence in any case in which he had made a *post-mortem* examination, or examined a wounded person, the medical officer should bring with him to court the original notes made by him at the time of conducting such examination.

XX. The notes of examination in all cases, or a fair copy of them, in the handwriting of the medical officer, should be at once made in a book kept at the hospital or dispensary for the purpose, and should be signed by him.

CHAPTER IV.

THE USE OF THE MICROSCOPE.

As every clinical student should at least understand the use of the microscope to enable him to use it for the purposes of diagnosis, a few words on the subject will be useful.

The difficulties in acquiring the necessary manipulative skill are not so great as is generally supposed: it only requires attention and practice to overcome them.

The instrument supplied to Government hospitals and dispensaries is the *compound microscope*. It differs from a simple microscope, inasmuch as the *image* formed by the object-glass is further magnified by one or more lenses forming an eye-piece or, in other words, the rays of light from an object being brought into a new focus, there form an image, which image being treated as an original object by the eye-piece is magnified in the same way as a simple microscope magnifies the object itself.

Generally speaking there are supplied two eye-pieces, a long and a short one, and two object-glasses an inch and a quarter-inch.

The long eye-piece and the inch object-glass magnify from 35 to 50 diameters. The long eye-piece and the quarter-inch object-glass magnify from 200 to 220 diameters. The short eye-piece magnifies the *image* formed by the object-glass somewhat more than the long one.

Before using a microscope, great care should be taken in cleaning the lenses, and after using it these glasses should be again wiped and the instrument carefully put away to preserve it from getting injured by dust or damp.

All compound microscopes are made up of the *optical portion* and the *mechanical appliances*. The optical portion includes the *object-glass* for magnifying the object, the rays of light from which are brought to a focus within the tube of the instrument; *the eye-piece* for magnifying the *image* formed by the object-glass; the *mirror* from which the light is reflected so as to pass through the object; the *bull's-eye condenser* for bringing direct rays of light to bear on opaque objects which cannot be examined by light transmitted by means of the mirror. The mechanical appliances consist of the *adjustments* for altering the focus; of these there are two, the *coarse* and the *fine*. The movements of the *coarse* adjustment are generally regulated by means of a rack and pinion, but in some microscopes they are regulated by the fingers alone, the tube being arranged to slide in another tube; either of these adjustments often requires a little Rangoon oil to make it move freely and with ease; the arrangement of the *fine* adjustment varies very much in different instruments; it allows of a more delicate motion when the high powers are used. The tube of the microscope is in many instruments supplied with a second portion which allows of its being elongated, the use of this being that the eye-piece still further magnifies the image formed by the object-glass in proportion to the length the tube is drawn out. The *body* of the microscope includes its stand and stage, both of which differ very much in different instruments; the stand should always be firm and heavy enough not to be easily shaken. Every microscope should be capable of being placed in a vertical, inclined, or horizontal position. The *stage* upon which the object to be examined is to be placed, if a movable one, should move easily and be kept very clean. Some microscopes are supplied with mechanical arrangements for moving the stage, but it is better for the student to train his fingers to move the glass slide on the fixed stage; most stages are supplied with clips for fixing the glass slide; the *diaphragm* is the circular plate below the stage with holes in it of different sizes to enable the observer to modify the amount of light transmitted; it should move freely; as a rule, for clinical work the hole of about the medium size will allow enough of light.

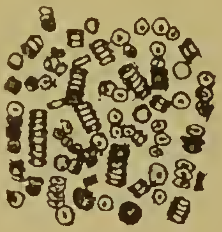
To adjust the microscope for work.—Choose the eye-piece and object-glass you wish to work with; the long eye-piece and the quarter-inch object-glass are the most generally useful for clinical work. See that they are clean, screw the object-glass into its place at the bottom of the tube and insert the eye-piece in the top. Fix the body of the instrument either vertically or at the angle you wish to work it. You should select a good light to work in, that from a white cloud is the best; reflect the light from the mirror through the opening in the stage, so that you can see light through the eye-piece; adjust the diaphragm so as to modify the light, place the glass slide in the clips on the stage and with the *coarse* adjustment gradually lower the tube till the object-glass all but touches the slide, then with one eye over the eye piece, raise the tube by means of the coarse adjustment till the object on the slide comes into view; having thus focussed the object, you can examine it in detail by gentle movements of the fine adjustment; while observing, your right finger and thumb should be constantly on the fine adjustment, the least movement of which shows you the object more thoroughly. Take care in lowering the tube with the coarse adjustment that you do not touch the thin glass over the object you are examining, and that you do not allow any moisture to get on the object-glass, as either will interfere with your observation.

Before commencing to work clean your thin glasses and plate-glass slides thoroughly.

A single drop of any fluid to be examined should be placed on the slide and the thin glass placed over it, thus:—breathe on the thin glass to moisten it, then grasp it with a fine forceps or with your finger and thumb and let one of its edges touch the margin of the fluid and allow it to sink slowly on the fluid in order to avoid air bubbles. Remove any superfluous fluid with a piece of blotting paper. The commonest mistakes are to put too much fluid under the glass and to let air bubbles in. It is much better to prepare two or three slides and examine them one after another; this must be done at once as they dry rapidly in hot weather.

Blood.—A drop of blood may be obtained for examination by pricking the finger with a needle, or making a slight scratch on any part of the body; very little is required; it should not be squeezed out as this tends to alter the proportion of the corpuscles to the serum and changes their shape; it should be placed on the slide in as thin a layer as possible and covered over with a thin glass. Examine with the long eye-piece and quarter-inch object-glass.

FIG. 13.



Blood Corpuscles × 212—'BEALE.'

The coloured corpuscles are circular discs $\frac{1}{3000}$ to $\frac{1}{3500}$ inch in diameter and $\frac{1}{10000}$ inch in thickness, depressed a little on each side; when seen sideways, biconcave or dumb-bell shaped; of a pale buff colour when isolated, but when aggregated of a reddish tint; they have a tendency to run together in rolls or rouleaux. Note a corpuscle as it rolls over and observe the change in its form, being alternately circular and biconcave. The corpuscle has no nucleus, the false appearance of a nucleus is occasioned by the refraction of light in passing through a biconcave disc. Prove this by slowly altering the focus. These corpuscles consist of two parts, a stroma, which is colourless, and the coloured part, a red crystallizable substance, *hæmoglobin.*

Colourless corpuscles.—Their proportion to the coloured varies, during fasting from 1 to 800 or 1,000, after a meal 1 in 300 or 400 according to Foster.* When perfectly fresh they are spherical and faintly granular; they quickly alter and become markedly granular. They are about $\frac{1}{2500}$ inch in diameter, nucleated, the nucleus not often apparent without the addition of weak acetic acid. They are nearly always isolated and do not collect together or mix with the coloured discs. They are endowed with a power of spontaneous motion (amœboid movement), but it requires close watching for some minutes to see these movements even in freshly-drawn blood.

Action of re-agents on blood.—Water causes the red corpuscles to become smooth and pale and disappear. Acetic acid does the same, but the colourless corpuscles become more distinct and their nuclei more apparent. Tannic acid causes the hæmoglobin to collect in small lumps at the side of the red corpuscles.

The corpuscles are changed in various diseases; in anæmia, particularly in pernicious anæmia, the red blood corpuscles are frequently found to be much diminished in number and size and in many cases to have a pale appearance due to loss of hæmoglobin. Sometimes they assume curious and irregular shapes. In various cachectic conditions the protoplasmic granules, which are to be found occasionally in normal blood, become much increased in number, and adhere together so as to form larger or smaller masses.

Leucocytosis signifies a slight and often temporary increase in the white corpuscles; it is seen in forms of chronic destructive diseases of the lungs, in some of the acute specific fevers where the lymphatic structures have been affected, and it is seen physiologically after each meal and in the later stages of pregnancy. In *leukæmia or leucocythæmia* there is a considerable and permanent increase in the number of white blood corpuscles and a diminution in the number of the red; it is associated with enlargement of some of the lymphatic organs, most frequently the spleen or lymphatic glands, and more rarely with an increase in the medulla of the bones.

Micro-organisms in the blood.—Many different forms of microphytes have been described in the blood and tissues as the causes of different diseases, for instance the *bacillus anthracis* in anthrax, the *bacillus tuberculosis* in tuberculosis, the *bacillus lepræ* in leprosy, the *streptococcus variolæ* in small-pox, the *diplococcus pneumoniæ* in pneumonia, the *spirillum* of Koch in cholera, the *spirillum Obermeieri* in relapsing fever, the *plasmodium malariæ* in malarial fevers, the *actinomyces* in actinomycosis, all of these are figured in the late Surgeon-Major McNally's *Hand-book of Sanitary Science.* The natural history of many of these is still incomplete. The most fully investigated are the following, and they can be found in the blood.

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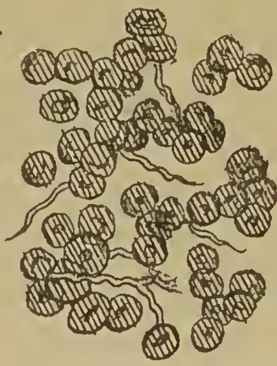
* *Text Book of Physiology.*

The *bacillus anthracis* is found in the disease known under the names of anthrax, woolsorters' disease, splenic fever and malignant pustule. "The blood is filled with short rods somewhat exceeding in length the diameter of a red blood-corpuscle, which, as the disease advances, becomes changed into long thread-like filaments. These forms are usually to be made out with considerable ease, but they will be rendered more distinct if the blood be allowed to dry on the cover-glass and then stained with methyl-violet or other appropriate re-agent."

Spirochœte Obermeieri.—Fig. 18. "This spirillum, which is found in the blood of patients suffering from relapsing fever, and was first described by Obermeir in 1872 and afterwards by Carter in 1879, possesses a very characteristic appearance. On examining a specimen of such blood with the microscope it will be seen that, moving actively among the blood-corpuscles, are a number of thread-like organisms; their length is usually three or four times greater than the diameter of a red corpuscle, and in shape they resemble a corkscrew; their movements are sometimes so powerful as to move the blood-corpuscles with which they come in contact."—*Graham Brown.*

FIG. 14.



Spirilla amongst red blood-corpuscles about—700.

THE MALARIA PARASITE.

The Malaria Parasite, discovered by Laveran in 1880, belongs probably to the order of Protozoa, that is, unicellular animal organisms which form spores (or similar bodies), such as the Gregarines or Coccidia. As, however, its life-history is not yet fully known, such a classification must be looked upon as being only tentative; and for the same reason no name more specific than that given above can at present be correctly assigned to it. The parasite exists in the peripheral blood, or in the vessels of the brain, spleen and some other organs, of all persons suffering from malarial disease; and can generally be found more or less readily in the blood of the finger. Nearly all of its existence in the human body is passed within the red corpuscles. In every case of malarial fever there are two cycles or orders of parasites, namely, those of the Sporulating Cycle and those of the Flagellum Cycle. The youngest parasites of the sporulating cycle are found within (or upon) the red corpuscles as small pale stains upon the hæmoglobin; and are possessed of more or less rapid amœboid movements which endure for an hour or more after the blood is drawn. As they grow older their bioplasm contains more and more *pigment*; that is, minute granules or rods, either motionless or rapidly oscillating, of a coal-black or brown substance which immediately attracts the eye and which is supposed to be derived from the hæmoglobin of the infected corpuscle. As the organism grows older it generally becomes more sluggish and so large as to fill one-third, two-thirds, or nearly the whole (according to its species) of the infected corpuscle. At last after a period, varying according to the species, of twenty-four, forty-eight, or seventy-two hours, a certain number of the parasites *sporulate*; that is, the pigment generally collects towards one point and the bioplasm splits up into from seven to twenty or more spores, which are then scattered by the bursting of the containing corpuscle in order to infect a fresh series of corpuscles. It is important to note that the parasites all sporulate nearly at the same time throughout the body, and that the rise of temperature in a case of malarial fever is synchronous with the bursting of the corpuscles and the scattering of the spores—facts which show that the parasites of the sporulating cycle are connected with the production of fever, besides being evidently the agents of the propagation of the animal within the human subject.

The parasites of the flagellum cycle probably possess neither of these functions, but may be set apart in order to continue the species outside the human body (*Manson*). Their young forms are, so far as is certainly known, similar in appearance to the young forms of the sporulating cycle. Their adults however or, as they may be called, flagellum cysts, do not sporulate; and present two different aspects according to the species. In the species of the malaria parasite which produce intermittent fevers, the adults of the flagellum cycle are large, round, plentifully-pigmented bodies; in those which produce remittent fevers, the adults are crescentic or sausage-shaped bodies, about 10 ɱ in length, and having all their pigment collected in a black mass in the centre. In the former fevers the adults of the flagellum cycle are found most commonly during the sweating or defervescent stage; in the latter, the crescents begin to appear only some days after the commencement of the illness, or even some days after the fever has temporarily or permanently disappeared. Both the spherical and the crescentic adults of the flagellum-cycle undergo (in a certain percentage of parasites) an extraordinary change from some minutes to an hour or more after the blood is drawn from the finger. On being carefully watched the crescents may be seen to lose their form, swell up and become of a spherical form similar to the flagellum cysts of the intermittent fevers. In a few more minutes, their pigment, which was collected in the centre, becomes scattered throughout the bioplasm and possessed of a violent oscillating or swarming movement. After another short interval a variable number (up to eight or more) of long whip-like or serpent-like bodies, the so-called flagella, issue from all sides of the cyst and remain attached to it for a few minutes by the proximal end, vigorously lashing meanwhile the corpuscles in the vicinity. They may now either die *in situ*, that is, still attached to the cyst; or may break loose and dart off in the *liquor sanguinis*, leaving the remains of the cyst with its black pigment lying motionless behind. The free flagella have been watched moving incessantly from place to place for many minutes; in one case for three hours. The spherical flagellum cysts of the intermittent fevers give origin to flagella in a very similar manner. It should be added that this phenomenon occurs only in blood after it has been drawn and never (so far as is known) in blood within the vessels. Lately Manson has suggested that the flagellum cysts are the homologues of the sporulating forms, giving rise, not to ordinary spores but to flagellated spores (the flagella).

There are four or five species of malaria parasites which produce distinct types of fever and have readily-perceived morphological differences; they are as follows:—

A. Intermittent or Spring Fever Parasites.—The parasites of the sporulating cycle are large, profusely pigmented and found in all their stages in the peripheral blood (*e.g.*, of the finger). The adult parasites of the flagellum cycle are spherical.

1. *Quartan Parasite* occupies ordinary-sized corpuscles. Pigment black and frequently motionless. Takes 72 hours to mature. Has 7–10 spores arranged in a regular rosette form.

2. *Spring Tertian Parasite* occupies large corpuscles. Pigment brown with active movement. Takes 48 hours to mature. Has 15–20 spores arranged in a bunch.

B. Remittent or Summer-Autumn Fever Parasites.—The parasites of the sporulating cycle are small, with scanty black pigment, and are found in the peripheral blood only in their youngest stages as small amœboid bodies containing little or no pigment and tending to form bright little rings when quiescent; the older parasites retire to the internal organs for sporulation. The adult parasites of the flagellum cycle are crescentic.

3. *Summer-Autumn Tertian Parasite* takes 48 hours to mature.

4. *Quotidian Parasite* takes 24 hours to mature.

5. *Unpigmented Quotidian Parasite* (*Mannaberg*) takes 24 hours to mature. The sporulating parasites contain no pigment (?)

It is difficult to distinguish the three last species morphologically from each other. Detailed particulars will be found in the essays by Marchiafava and Bignami, and by Mannaberg in Vol. CL of the new Sydenham Society's publications. See also Thayer and Hewetson, Johns Hopkin's Hospital Reports, Baltimore. But it is necessary to add here that a person wishing to see the parasite should ask some one familiar with the subject to show it to him and should not, unless forced to, proceed upon written descriptions, since, if he does so, he will probably be misled. The best time to examine the blood is when the temperature is rising, and for ordinary purposes fresh specimens are better than stained ones.

Enumeration of the corpuscles of the blood.—This was first attempted by Vierordt. Dr. Gowers' instrument as described in the *Practitioner* for 1878 is the one used in the General Hospital, Madras. This *hæmacytometer* consists of (*a*) a small pipette which when filled to the mark on its stem contains 995 cubic millimeters; (*b*) a capillary tube marked to contain five cubic millimeters; each of these is furnished with an india-rubber tube and mouthpiece; (*c*) a small glass jar in which the blood is to be diluted; (*d*) a small stirrer for mixing the blood and the solution in the jar; and (*e*) a brass stage-plate carrying a glass slip on which is a cell $\frac{1}{5}$th of a millimeter deep. The bottom of this is divided by intersecting lines into $\frac{1}{10}$th millimeter squares. Upon the top of the cell rests the cover glass, kept in position by means of two springs. The diluting solution may vary; one which answers well consists of a solution of sulphate of soda in distilled water, having a specific gravity of 1025.

When an observation has to be made, 995 cubic millimeters of the solution are measured by means of the pipette and placed in the mixing jar. The patient's finger is now to be pierced with the spear-pointed needle supplied along with the instrument, and a drop of blood obtained without any squeezing of the finger. Five cubic millimeters of this blood are drawn into the capillary tube, and then blown into the diluting solution in the jar, any superfluous blood being previously removed from the point of the pipette by means of a soft cloth. The two fluids are well mixed by rotating the stirrer between the finger and thumb, after which a small drop is placed in the centre of the cell, and the cover-glass applied. The drop must lie in the middle of the cell and must not touch its sides. The slip is now placed on the stage of a microscope, and the lens focussed for the squares, which are marked out by lines drawn on the floor of the cell. In a few minutes the corpuscles sink through the drop and come to rest on these squares. The number of corpuscles in ten squares is then counted, and this multiplied by 10,000 gives the number in a cubic millimeter of blood. There is a very slight error due to the mechanical imperfection of the instrument, but it does not matter for clinical purposes. The most recent calculations show the number given by Vierordt, 5,000,000 per cubic millimeter, is approximately correct. The average number in two squares is 100, and Gowers proposes to take this quantity as the 'hæmic unit.' This is a very convenient way of calculating, for the number of corpuscles per 'hæmic unit,' *i.e.*, in two squares (counting ten or twenty squares, and taking the mean), expresses the percentage proportion of the corpuscles to that of health. The number of white corpuscles in ten or twenty squares is easily counted, and the proportion of white to red ascertained. The normal *maximum* of white per two squares (hæmic unit) is ·3.

In all conditions of anæmia and cachexia the number of red corpuscles undergoes diminution and by examining their number from time to time we can obtain most valuable and trustworthy indications regarding the progress of the malady and the effect of treatment.

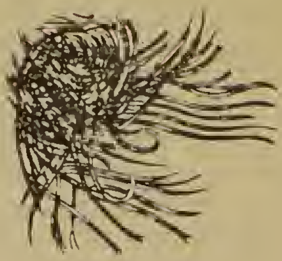
Estimation of hæmoglobin.—Dr. Gowers described an instrument in the *Transactions of the Clinical Society of London*, Vol. XII, for this purpose. It consists of two glass tubes of the same diameter, and a standard colour-solution of glycerine carefully tinted by means of carmine and picrocarminate of ammonia so that its tint corresponds exactly with that of a dilution of twenty cubic millimeters of blood in 1,980 cubic millimeters of distilled water, *i.e.*, a dilution of one in a hundred. One of the glass tubes is to contain the standard solution, the other, in which the blood to be tested, is to be diluted, and is graduated so that 100 degrees = two cubic centimeters. There is also a capillary pipette graduated to hold twenty cubic millimeters, a bottle with a pipette stopper to contain distilled water, and a guarded needle to prick the finger.

The method of using this instrument is as follows. The two tubes having been placed upright in the small wooden stand supplied for the purpose, a few drops of distilled water are placed at the bottom of the graduated tube. The blood having been obtained from a prick in the manner already described, twenty cubic millimeters of the blood are measured off by means of the pipette, and injected into the distilled water in the graduated tube, which must then be quickly shaken to ensure thorough mixture. More distilled water must now be added drop by drop until the tint of the diluted blood is the same as that of the standard. The degree of dilution, as indicated by the graduation, expresses the amount of hæmoglobin as compared with that of the standard, and as this is the dilution of one hundred, the degree of dilution required to obtain the same tint represents the percentage proportion of the hæmoglobin to that of normal blood; thus if the tints are identical when the dilution has reached 80 degrees, the blood contains 80 per cent. of the normal quantity of hæmoglobin.

If the corpuscular richness of the blood is ascertained by means of the hæmacytometer we are able to compare this with the amount of hæmoglobin in a very instructive manner. Thus, a fraction, of which the numerator is the percentage of hæmoglobin, and the denominator the percentage of corpuscles, will express the average value of each corpuscle.—*Graham Brown*, *Medical Diagnosis.*

Expectoration.—The basis of all kinds of expectoration is the natural secretion of the mucous membrane of the air tubes, which is a transparent, colourless, glutinous liquid, consisting chiefly of water, mucus and saline matter. In simple catarrh, the natural secretion is merely increased in quantity; in bronchitis the sputum is often glairy like white of egg and streaked with blood; in hæmoptysis the expectoration for a short time may consist entirely of blood; in phthisis purulent fluid and portions of softened tubercle are expectorated, occasionally with cretaceous or calcareous masses of phosphate and carbonate of lime; in pneumonia at the outset, there is merely expectoration of bronchial mucus, but in two or three days the sputa may assume a very characteristic appearance, being transparent, tawny or rust-coloured, and united into a jelly-like mass of great viscidity. Albumen is found in cases of inflammation of the lung substance or air passages; sugar, sometimes in diabetes, and urea in cases of chronic renal disease. The following classes may be recognized, though they are often intermingled, (*a*) mucous, (*b*) muco-purulent, (*c*) purulent, (*d*) serous, (*c*) sanguineous.

FIG. 15.



Fragment of areolar and elastic tissue of the lung found in phthisical sputum:—after Bennett.

To examine the sputa microscopically they should be thrown into water, when the lighter portions will float on the surface, while the more dense sink. These latter can then be broken up, transferred to a staining solution of logwood * in a watch glass for a few minutes and then placed on a glass slide with a drop of water or salt solution for examination.

The matters usually found consist of epithelium, which can be best seen after staining with an aniline dye, portions of food, muscular fibres, oil globules, fibres of various kinds, starch granules, and occasionally vegetable fungi which are often present about the fauces. To detect lung tissue, the plan of Dr. Fenwick may be followed: shake up the expectoration coughed up by the patient during twelve or twenty-four hours—from ten at night to ten the next morning being the best period—with an equal quantity of solution of caustic soda (20 grains to an ounce of water) and boil it in a glass beaker stirring it occasionally with a glass rod. As soon as it boils, it becomes liquid, then pour it into a conical glass and add four or five times the quantity of cold distilled water. If the mucus be still gelatinous the fluid is not boiled sufficiently, or enough caustic soda has not been added to it. The lung tissue, if present, will sink to the bottom of the glass, forming a slight deposit in a quarter of an hour, and can readily be removed by a dipping tube, then stained in the logwood solution and examined with the microscope, the air cells will be detected very often; bronchial tubes of minute size, and bits of arteries may also be seen. *Fibrinous bronchial casts* are sometimes found in cases of pneumonia and croupous bronchitis.

Crystals soluble in ether are sometimes found, especially the fine colourless needle-shaped crystals of the fatty acids in cases of bronchitis, bronchiectasis and pulmonary gangrene. Charcot's crystals are supposed by some to be the exciting cause of the paroxysm of asthma by irritating the terminations of the vagi; they are usually long, fine, sharp and spindle-shaped; they are colourless and insoluble in alcohol, but are readily dissolved by acids or alkalies; their composition is still a matter of doubt.

The **tubercle bacillus** described by Koch is a delicate, rod-shaped structure, in length usually about one-fourth or one-third the diameter of a blood corpuscle, and is motionless. It cannot be detected but by careful staining, and Koch has given up the method he recommended at first for the one adopted by Ehrlich.

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* *Note.*—The staining solution may be made as follows:—

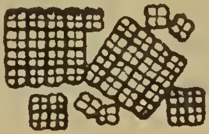
Logwood chips, 80 grains; water, 800 c.c. Soak for 24 hours and add ½ per cent. alum solution, 1·400 c.c.; spirit of wine, 120 c.c.—Filter.

The advantage of this fluid is due to the elective affinity the stain has for the nuclei of cells, which when stained are seen much more distinctly.

Ehrlich's method of staining tubercle-bacilli.—"The sputum is spread in a thin layer on a cover-glass and dried. In order to fix the albumen the cover-glasses are kept at a temperature of 212° to 230° F. for an hour; or in practice it is sufficient to pass them three or four times through a gas or spirit-lamp flame. The staining solution is prepared as follows:—About five cubic centimeters of pure aniline are added to 100 cubic centimeters of distilled water, well shaken and then filtered through a moistened filter. To this mixture, a saturated alcoholic solution of fuchsine, methyl-violet, or gentian violet, is added till precipitation commences. The cover-glass is allowed to float on this, with the side on which the sputum has been spread directed downwards, for a quarter to half an hour. It is then washed for a few seconds in a strong solution of nitric acid (one part of commercial nitric acid to two parts of distilled water), and afterwards in distilled water. In this way, the stain is extracted from everything but the tubercle-bacilli. The ground substance may be stained brown (if the bacilli have been stained violet), or blue (if the bacilli have been stained red), by way of contrast to the bacilli. The examination of sputa after this method is employed in Berlin as a means diagnosing tuberculous affections of the lungs, for the bacilli are constantly present in sputa in cases of tubercle." *

Vomited matters.—The chief substances found are epithelium, mucus, blood and pus corpuscles, starch granules, dortions of undigested food, torulæ and other varieties of vegetable fungi resembling the yeast plant, vibriones and sarcinæ.

FIG. 16.



Sarcinæ ventriculi.

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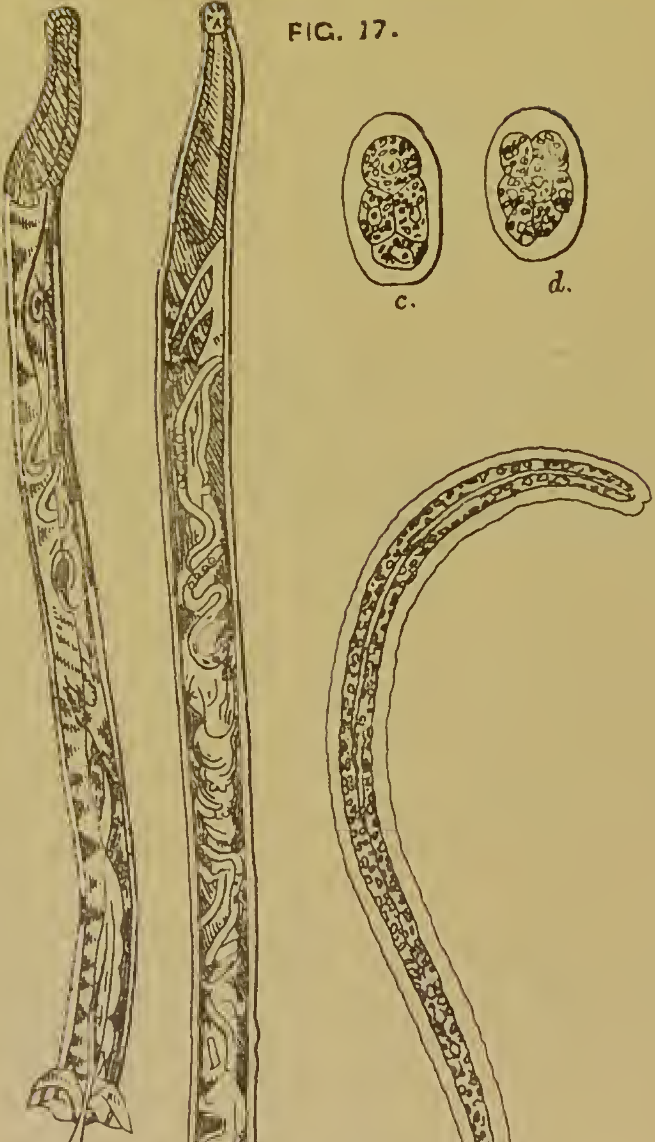
* *British Medical Journal*, June 17, 1882.

The **sarcinæ ventriculi**, a fungus first described by Goodsir, consist of square bundles, divided by vertical and horizontal lines into four parts, each having a resemblance to a woolpack, whence its name: they are seen either signly or aggregated into masses. These vegetable parasites are found in the vomit when it is very acid and when it resembles yeast in appearance. Sarcinæ are chiefly found in connection with pyloric obstruction. They have also been found in the urine, fæces and in the fluid of the ventricles of the brain.

In 'coffee-ground vomit,' blood cells and altered hæmatin are found: 'bilious' vomit contains epithelial cells, biliary colouring matter, and fat globules.

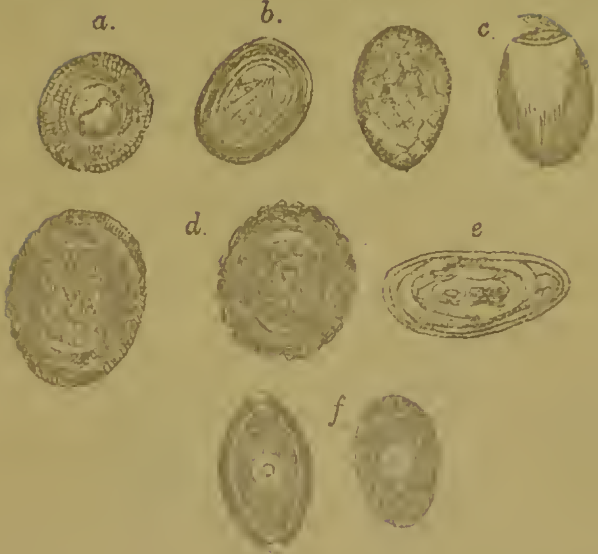
Fæces.—It is occasionally necessary to wash the fæces in water and examine them for the ova of the different intestinal parasites, also for shreds of tissue from the mucous membrane in cases of ulceration.

FIG. 17.



a b Mature specimens of anchylostoma duodenale (*a*), male; (*b*), female. *c d*, The ova in stages. *e* Mature larva (after Perroncito).

FIG. 18.



Ova of worms. (*a*) Ripe ova of tænia solium. (Leuckart.) (*b*) Ripe ova of t. media canalata. (Davaine). (*c*) Ova of bothriocephalus latus, empty and containing yolk. (Leuckart.) (*d*) (Ova of the ascaris lumbricoides. (*e*) Ova of oxyuris vermicularis. (Leuckart.) (*f*) Ova of trichocephalus dispar. (Leuckart.)

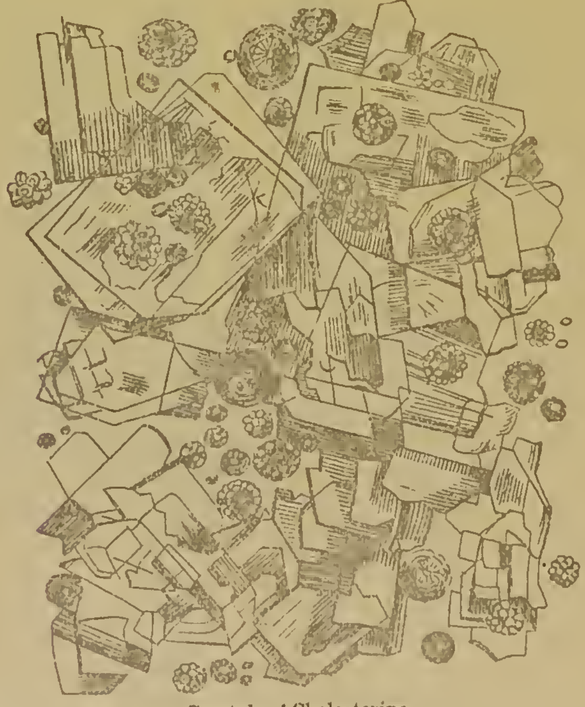
Anchylostoma duodenale or anchylostomum duodenale, or sclerostoma duodenale, or dochmius duodenale was discovered in Milan by Dubini in 1838. It belongs to the genus dochmius, order nematodes, family Strongylidæ. The disease produced by its presence is called anchylostomiasis or anchylostomosis. The form of the body of the worm is fairly compact and cylindrical; the length exceeds the breadth twenty times; its colour may be whitish, ash coloured, reddish, or black. The head is plainly seen bent towards the dorsal side. The posterior extremity is not bent; it is pointed in the female and broad in the male. Its length varies from 6 to 15 mm. The female is longer than the male. They are found in the upper part of the small intestines in the duodenum, and particularly in the upper part of the jejunum, where they avoid, according to Bilharz, the direct effects of the bile. They live by suction of blood from the intestinal walls, causing anæmia with destruction of the red blood corpuscles.

How to detect the worms and the ova in the fæces.—Pour the fæces out on porcelain plates and examine for the worms or the larvæ; if none are found, take a small portion of the fæces, dilute it, if necessary, with distilled water, place it on a slide and examine with a quarter-inch object-glass.

On *post-mortem* examination the anchylostoma may be found attached to the intestinal wall and adhering firmly to the mucous membrane if the examination be made soon after death, or loose in the mucus if made later. There are often small and large hæmorrhages under the mucous membrane. Brigade-Surgeon Kynsey, the Principal Civil Medical Officer and Inspector-General of Hospitals in Ceylon, wrote an interesting and careful report on anæmia and beri-beri in Ceylon in 1887 in which he considers that the cause of beri-beri is this worm. It is, however, often found in other cases of anæmia, where the classical symptoms of beri-beri are absent, see *Transactions of the South India Branch B.M.A.*, Vol. II, pages 41 and 74. It has also been found, by Surgeon J. Smyth, M.D., in the intestines of a healthy young Hindu who had been killed by a fall from a tree.

Urine.—Some plates of the different crystals and renal casts most commonly found in urine will be seen at pages 170 to 176; their significance and the methods of examination are more fully described in the chapter on the subject.

FIG. 19.

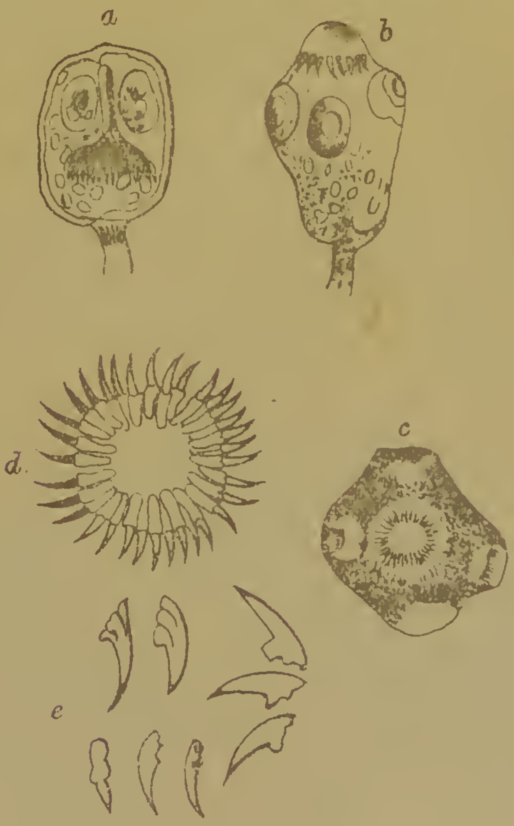


Crystals of Cholesterine.

Obtained from the fatty matter in casts separated from the urine of a case of fatty degeneration of the kidneys.—'BEALE.' × 215.

Serous fluids.—These should all be allowed to stand for a time in order that any solid matters may settle before examination. The bodies found in the contents of the serous cavities are mainly epithelial cells and granules. If there be inflammation we have more or less pus cells, shreds of fibrin, oil globules, spherical cells, cholesterine; in the fluid of hydatid cysts hooklets and heads of the ecchinococcus are found; in that of hydrocele epithelial débris, spermatozoa occasionally and cholesterine; in ovarian cysts, spherical, nucleated, or granular cells, granules, oil globules, and blood corpuscles will be found. In lymphatic cysts and in the fluid

FIG. 20.

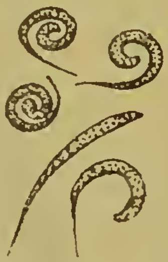


Tænia Ecchinococcus.

[a] With head retracted. [b] With head extruded.
[c] One viewed transversely, the head being directed towards the observer.
[d] Circlet of hooks seen upon its under surface, thirty-four in number.
[e] Lateral views of the separate hooklets;—after Aitken.

exuded from the 'lymph scrotum' the *filaria sanguinis hominis* will be found. In the fluid of the blister which forms over the place of exit of a Guinea-worm numerous embryos will be seen.

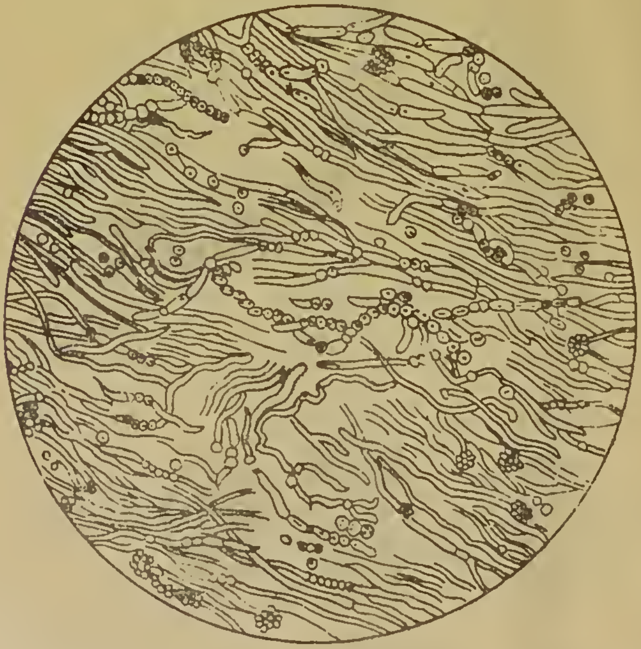
FIG. 21.



Young of Guinea-worm more or less spirally curved;—after Bastian.

Parasitic skin diseases.—A very slight scraping of the epithelial scales situated at the edge of a diseased patch, or an actually diseased hair should be placed at once in diluted liquor potassæ for examination.

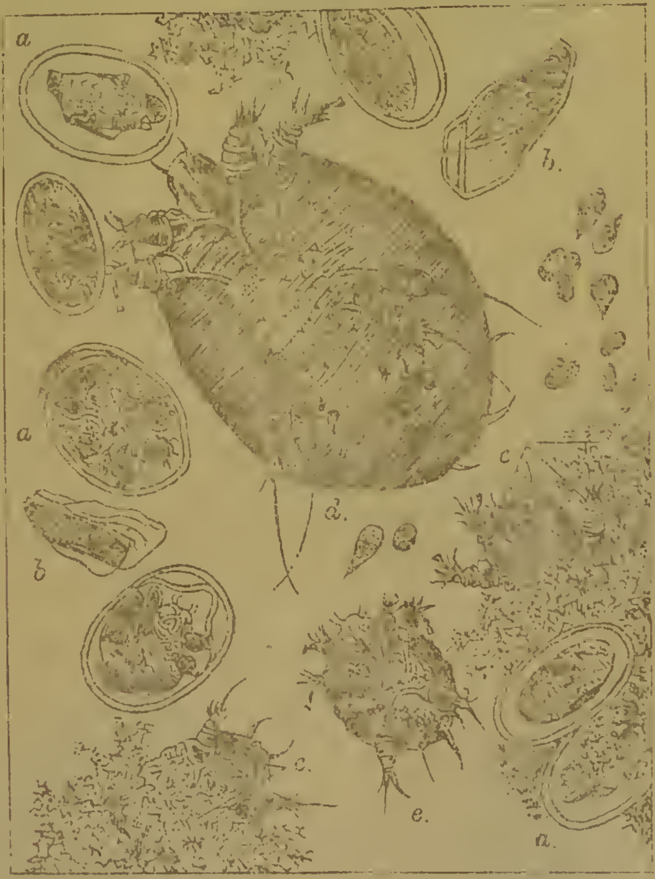
FIG. 22.



Ringworm. *Trichophyton Tonsurans*;—after Tilbury Fox.

In examining for the *acarus scabiei*, the crusts should be selected, in the 'furrow' the eggs will be found. If a needle be introduced in the furrow the insect will generally seize its point and may be withdrawn for examination.

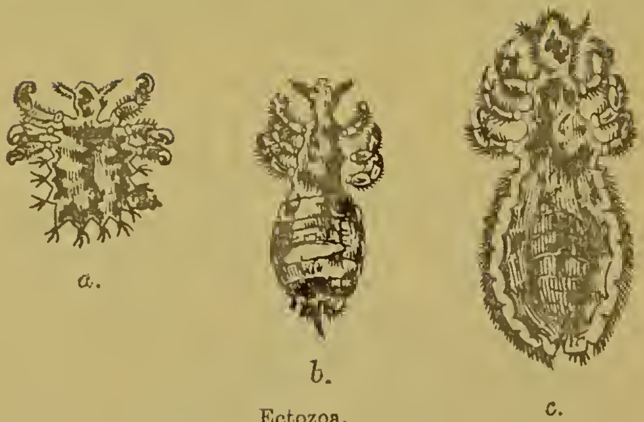
FIG. 23.



Crust from a case of scabies and eggs of acarus in various stages of development, *b.b.* Egg Shells, *c.c.* Fragments of acari. *d.* Female acarus. *e.* Male acarus. The little oval or irregular-shaped masses are supposed to be excrement:—after Tilbury Fox.

The ectozoa are not at all uncommon in this country amongst the lower classes. The following plates will give a good idea of their microscopic appearance:—

FIG. 24.

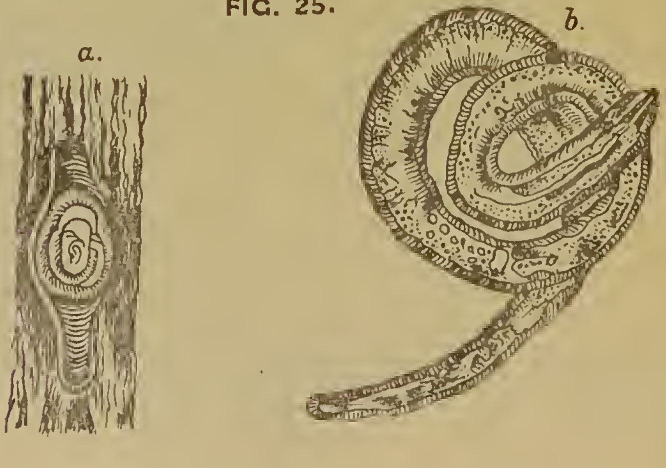


Ectozoa.

[*a*] Phthirius inguinalis or crablouse.
[*b*] Pediculus capitis or head louse.
[*c*] Pediculus vestimenti or body louse.

Amongst the *entozoa* found in man the *trichina spiralis* is found as a more or less transparent capsule lying between the sarcolemma of the primitive muscular fibres, but when the parasite is free it finds its way within the sheath. It is the cause of the *trichinotous* disease in animals and man.

FIG. 25.



Trichina Spiralis.

a. within the capsule; *b*. capsule removed.

Pathological histology.—Much may be learnt by means of the microscope from the examination of portions of tumours, or from the examination of *post-mortem* specimens in their fresh state. The student cannot hope to do much at this kind of work until he has gone through a course of histology in the class for the study of the microscope, and is never likely to understand pathological changes until he has learnt the appearance of the healthy tissues.

Thin sections of the soft tissues for examination under the microscope can be readily cut and stained in the following manner. Small pieces of the tissue, say quarter-inch cubes, are placed in twenty times their bulk of spirit to get rid of the water in them; they are then transferred to a solution of magenta in oil of cloves and left in it for twelve to twenty-four hours when they will have been well permeated by the stain; if the tissue is fibrous it may take forty-eight hours. The pieces are then removed to a bottle containing melted cocoa-butter * and kept there exposed to the sun for ten hours, so that they may become saturated with the butter. One of the pieces can now be taken out and placed on the end of a cork to which it is to be attached by pouring a little cocoa-butter over it, and allowing it to stand by for a few hours till the butter solidifies. The tissue can now be cut with a razor in the usual way, the razor being kept wet with spirit during the process. The sections had better be floated into spirit from which they can be transferred to a slide for mounting.

When the section is in position on the slide superfluous spirit should be removed with the corner of a bit of blotting paper, and then a drop of clove oil is poured over it and the cover glass applied carefully so as to exclude all air. There will still be a little of the cocoa-butter in the interstices of the section and this is now to be removed by gently warming the slide over a spirit lamp; the butter if present will thus be driven out round the edges of the cover glass and is to be wiped away. A little Canada balsam or other cement may now be painted round the edge of the cover glass if it is proposed to preserve the section.

By means of a freezing microtome perfectly fresh tissue may be cut and examined.

The *razor* used in section-cutting should be broad-bladed and hollow ground; the original 'army razor' is very good.

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* To be had at Messrs. Smith & Sons, Chemists, Madras.

It should always be stropped in one direction, and must be very sharp. In order to use it, hold the razor firmly in the right hand with the fingers closed above the handle, take the mass to be cut between the index finger and thumb of the left hand, support the back of the razor on the mass and cut from left to right, and from the heel to the tip of the razor. The handle should be kept in a line with the blade. It requires much practice to make thin sections.

Valentin's knife is sometimes used for cutting sections from fresh tissues. It consists of two blades, which can be separated to the desired distance by a screw. The section is cut between them by drawing the knife *rapidly* through the tissue, separating the blades, and floating it off into water.

Thin membranous structures may be examined by simply staining them, spreading them out in a drop of water placed upon a glass slide, and covering them with a thin glass. In the examination of tumours much may be learnt by gently scraping the freshly-cut surface with a knife, staining the elements thus separated and examining them in glycerine.

Teasing is done by placing a *small piece* of the tissue in a drop of either glycerine or normal saline solution on a slide, and teazing it in the direction of its fibres with two strong needles mounted in handles. The tissue should be stained beforehand in the logwood solution.

A section lifter * can be easily made by beating out flat one end of a thick copper wire, four or five inches in length; the flattened portion should be filed at the edges and rubbed smooth with sand-paper.

Normal *saline solution* is a ·75 per cent. solution of chloride of sodium.

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* *Manual for the Physiological Laboratory.*—HARRIS and POWER.

CHAPTER V.

POISONS AND ANTIDOTES.

I. CORROSIVE IRRITANTS.

Mineral acids ... Sulphuric, Hydrochloric, Nitric.	Avoid stomach pump. Laryngotomy, if suffocation threatens. Give chalk, or preferably magnesia, carbonate of soda, and mucilaginous drinks.
Alkalies ... ... Potash, Soda, Ammonia, Carbonates of.	Same as above, but instead of alkaline drinks give dilute acids: preferably vegetable acids, sour beer, vinegar, lemon juice; and demulcents such as linseed tea, barley water.

II. NON-METALLIC AND METALLIC IRRITANTS.

Phosphorus ...	Emetics or stomach pump. Avoid oils and fatty matters. Turpentine in 30 minim doses, in mucilage, every $\frac{1}{4}$ of an hour.
Arsenic compounds. White arsenic, Orpiment, Realgar, Scheele's green Fowler's solution.	Wash out stomach. If no vomiting, encourage it by emetics and copious draughts of warm water. Freshly precipitated hydrated ferric oxide: tinct. ferri per chloridi rubbed up with magnesia, or precipitated by adding liquor ammoniæ. In latter case, filter through calico, wash precipitate by stirring it in water, pour off water, and administer the precipitate in demulcent drink. Thirty-two grains of this antidote are required for each grain of white arsenic.
Antimony compounds. Tartar emetic, Butter of antimony, Pulv. antimonialis.	As for irritant poisoning; also infusions containing tannin, decoction of cinchona bark, strong tea. Stimulants may be required.

Mercury compounds— Corrosive sublimate. Calomel. Cinnabar. Red precipitate. Zinc compounds— Zinc sulphate. Zinc chloride. Copper compounds— Blue vitriol. Verdigris. Lead compounds— Sugar of lead. Silver nitrate. Ferrous sulphate (Green vitriol). Ferric chloride.	Albumen (white of egg), followed by washing out of stomach. If corrosive effects are present, (as in zinc compounds) avoid stomach pump, and vomiting should be promoted by emetics and warm water. In poisoning by mercurial or copper compounds albumen is especially useful; zinc compounds are antidoted by carbonate of soda, lead compounds by sulphates such as those of soda or magnesia, silver nitrate by common salt, iron salts by magnesia.

III. VEGETABLE AND OTHER IRRITANTS.

Elaterium	Emollient and demulcent drinks and enemata, followed by small but repeated doses of opium, with the use of the warm bath.
Croton seeds and oil ...	Emetic of copper sulphate (10 grains dissolved in water) followed by mucilaginous fluids, and opium to check diarrhœa.
Cantharides	Emetics, emollient drinks avoiding oily demulcents; opium by mouth or rectum and warm bath to relieve pain, opiate injections into bladder.
Pounded glass ...	Bulky food so as to envelope fragments, followed by emetics and laxative.

IV. CEREBRAL POISONS.

Hydrocyanic acid and cyanides ...	Fresh air, artificial respiration with cold effusion; freshly precipitated oxide of iron (*vide* arsenic compounds).
Carbolic acid	Castor oil and sweet oil mixed, saccharated solution of lime, albumen; strong tea or coffee.
Chloroform	Cold affusion, artificial respiration, galvanism to spine and epigastrium.
Chloral	Evacuate stomach; strong decoction of coffee; artificial respiration.
Opium ... ... Morphine	Animal charcoal; evacuate stomach by emetics or stomach pump; external stimulants; cold affusion; ammonia to nostrils; compelled exertion; artificial respiration if required. Tincture of belladonna 10 minims every half hour; atropine hypodermically $\frac{1}{120}$ grain at first, repeated every hour, or 4 minims of liquor atropiœ subcutaneously repeated every quarter of an hour till pupils dilate. 1 grain of potassium permanganate in a cupfull of water from time to time has been tried with success. It decomposes morphine grain for grain.*
Cannabis indica, Dhatura, Belladonna (atropine), Hyoscyamus.	Emetics, or stomach pump; if pulse feeble and skin cold, give stimulants; if narcotism present, use cold affusions, &c., as in opium poisoning. If much excitement present, opium may be given.

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* *Indian Medical Record*, Feb. 1st, 1806, page 81,

V. SPINAL POISONS.

Strychnos Nux vomica (Strychnine). Calabar bean, Conium, Aconite.	(1) Evacuate stomach by emetics or stomach pump. (2) Prevent further action by giving animal charcoal, gallic acid, or infusions containing tannin. (3) Counteract effects by stimulants, artificial respiration, &c., as required. In strychnine cases, keep patient under chloroform. In calabar bean poisoning, give hypodermic injunctions of atropia sulphate ($\frac{1}{120}$ to $\frac{1}{60}$ grain) every hour till pupils dilate and pulse rate increases. In aconite cases, administer atropine as above, or if much tendency to syncope is present digitalis is advised.

VI. CARDIAC POISONS.

Tobacco, Digitalis, Nerium odorum (oleander).	Evacuate stomach; stimulants externally and internally. Recumbent position most important. Hypodermic injections of strychnine recommended in tobacco poisoning.
Snake poisons	At once apply a thick India-rubber band or cord tightly round the limb above the bitten part. Failing this, apply two or three ligatures a few inches apart, and tighten the one nearest the wound by twisting it with a stick. Then freely excise the bitten part; in the case of the fingers or toes excise down to the bone or even amputate at the joint nearest above the wound. After excision wash the wound

with solution of caustic potash or of potassium permanganate, and remove the ligature. If the bite has been inflicted at a point which does not admit of the application of a ligature, the indication then is to promptly excise the wounded tissue together with the surrounding parts.

The patient should rest perfectly quiet. As soon as indications of poisoning are perceived, preparations of ammonia (liquor ammoniæ) are to be administered, or, what is still better, he should be made to drink copiously and frequently of spirituous liquors diluted with hot water, taking care, however, not to produce intoxication. Should symptoms of collapse supervene, sinapisms, galvanization of the heart and diaphragm, or cold douches may be resorted to.* It is advisable to find out when possible whether the snake was a poisonous one, and to remember that it may not have been in an active state, and its poison may have been feeble or may not have been injected in sufficient quantity into the wound.

On washing out the stomach.—Should the stomach pump be of out order, the following directions by Professor Esmarch † will be of use: "Get, if you can, a piece of guttapercha tubing an inch in circumference, and, if the patient is not unconscious, make him swallow twenty to twenty-five inches of it, enough to reach the stomach; raise the free end above his head, and by means of a funnel, pour as much water down as the stomach will receive, then lower the free end below the level of the stomach and the stomach will empty itself. Repeat the process several times."

NOTE.—A Toxicological Chart compiled by Mr. W. Stowe has been published by Messrs. Joll of New Burlington St., London. It gives fully the symptoms, treatment, and tests of all poisons, mineral, vegetable, and animal; also hints on the treatment of suspended animation from different causes. It should be hung in the dispensary of all hospitals.

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* *Von Ziemssen's Cyclopædia*, Vol. III, page 548.
† *First Aid to the Injured*, 1882.

CHAPTER VI.

DIETING OF THE SICK.

The following dietary is used for the Government Civil Hospitals in Madras :—

Table of Diets for Native Patients.

Spoon.	Milk.	Coffee.	Half.	Full.
Rice 6 oz. Salt 1 80 grs.	Bread or rice ... 12 oz. Milk ... 1½ pts. Sugar ... 2 oz. *For Conjee.* Rice ... 2 oz. Salt ... 60 grs.	Bread ... 12 oz. Coffee ... 1 pt. Sugar ... 1 oz. Milk ... 4 „ Hoppers ... 2 no. Sugar ... 2 oz. *For Conjee.* Rice ... 2 oz. Salt ... 60 grs.	Rice ... ... 12 oz. Mutton ... 4 „ Ghee ... ½ „ Curry-powder. ¼ „ Tamarind ... ⅜ „ Vegetable ... 2 „ Salt ... ... ½ „ Coffee ... ½ pt. Sugar ... ½ oz. Milk ... 2 „ Hoppers ... 2 no. Buttermilk ... ½ pt. Pepper-water. ½ „	Rice ... 20 oz. Buttermilk ½ pt. Pepper-water ½ „ Mutton ... 6 oz. or Fish ... 4 „ Dhall ... 1 „ Vegetable 4 „ Curry-powder ½ „ Tamarind... ½ „ Gingelly-oil. 1 „ Salt ... ¾ „ Hoppers ... 2 no. Coffee ... ½ pt. Sugar ... ½ oz. Milk ... 2 „

NOTES.—1. On half diet mutton is given every day; on full diet it is given one day, vegetables, dhall and fish the next day.

2. Extras may be ordered on all diets except full. But stimulants and eggs may be given with any diet.

3. Arrack is the only stimulant allowed for natives, except under special circumstances (G.O., dated 1st January 1889, No. 1).

4. The meat in the various diets should weigh in the raw state, exclusive of bone, the weights specified in the table. If meat is issued with bone, an additional 4 oz. per pound should be allowed.

5. Each hopper should weigh 2 oz.

6. Medical officers may, in exceptional cases, diet patients on extras alone.

7. Rice conjee is preferred by natives; if any other kind is required, it can be ordered as an extra.

Time Table of Diets for Native Patients.

Spoon.	Milk.	Coffee.	Half.	Full.
		*Early Breakfast, 6 or 6–30 a.m.**		
Rice Conjee ... 1 pt.	Rice Conjee ... 1 pt.	Coffee ... ... 1 pt. Hoppers ... ... 2 no.	Coffee ... ... 1 pt. Hoppers ... ... 2 no.	Coffee ... ... 1 pt. Hoppers ... 2 no.
		First Meal, 10–30 or 11 a.m.		
Rice Conjee ... 1 pt.	Milk ... ... 1 pt. Bread or Rice ... ... 6 oz. Sugar ... ... 2 ,,	Bread .. ... 6 oz. Sugar ... ... 2 ,, Rice Conjee ... 1 pt.	Rice ... 6 oz. Mutton ... 2 ,, } Vegetable ... 1 ,, } Buttermilk. ½ pt.	Rice ... ... 10 oz. Mutton ... 3 ,, or Vegetable ... 4 ,, and Dhall ... 1 ,, Buttermilk ... ½ pt.
		Night Meal, 5–30 or 6 p.m.		
Rice Conjee ... 1 pt.	Milk ... ... ½ pt. Rice or ... 6 oz. Bread.	Coffee ... ... 1 pt. Bread ... ... 6 oz.	Rice ... ... 6 oz. Mutton ... 2 ,, Vegetable ... 1 ,, Pepper-water ... ½ pt.	Rice ... ... 10 oz. Mutton ... 3 ,, or Fish ... ... 4 ,, Pepper-water. ½ pt.

NOTE.—The water used for boiling rice should have a little salt added to it from the diet and be served out in half pints to those patients getting rice.

* Superintendents may modify the hours to suit their own hospital requirements.

Table of Diets for European Patients.

Spoon.	Milk.	Half.	Mixed.	Full.
oz. Arrowroot ... ... 1 Sugar ... ... 1 Tea ... ... ½ or Coffee ... ... 1 Sugar ... ... 1 Milk 4	Bread ... ... 12 oz. Hoppers ... ... 2 no. Milk ... ... 2 pts. Butter ... ... 1 oz. Tea ... ... ½ ,, or Coffee ... ... 1 ,, Sugar ... ... 1 ,, Milk .. ... 4 ,,	Mutton or Chicken ... 10 oz. Bread ... ... 16 ,, Hoppers ... ... 2 no. Butter ... ... 1 oz. Potatoes ... ... 8 ,, Salt ... ... ¾ ,, Ghee ... ... 1 ,, Tea ... ... ½ ,, or Coffee ... ... 1 ,, Sugar ... ... 1 ,, Milk ... ... 4 ,, If 'Half boiled' issued— Onions ... ... 1 oz. Barley ... ... ½ ,, Flour ... ... ½ ,, and omit Ghee. If stewed— Pepper ... ... 30 grs. Onions ... ... 1 oz. Flour ... ... ½ ,, Mint and Parsley ... 30 grs.	Mutton 8 oz. Bread ... ... 12 ,, Rice ... ... 8 ,, Hoppers ... ... 6 no. Butter ... ... 1 oz. Country Vegetable ... 6 ,, Curry-powder ... ½ ,, Tamarind ... ... ½ ,, Salt ... ... ¾ ,, Ghee ... ... 1 ,, Tea ... ... ½ ,, or Coffee ... ... 1 ,, Sugar ... ... 1 ,, Milk ... ... 4 ,,	Mutton ... 12 oz. Bread ... 1 lb. Hoppers ... ... 2 no. Butter ... ... 1 oz. Potatoes ... ... 8 ,, Country Vegetable .. 8 ,, Salt ... ... ¾ ,, Ghee ... ... 1 ,, Tea ... ... ½ ,, or Coffee ... ... 1 ,, Sugar ... ... 1 ,, Milk ... ... 4 ,, If 'Full boiled'— Onions ... ... 1 oz. Barley ... ... ½ ,, Flour ... ... ½ ,, and omit Ghee.

NOTES.—1. The meat in the 'Half' diet may be chops, cutlets, grilled, stewed, minced or boiled; in 'Full,' roasted, grilled or boiled only.

2. Extras may be ordered on all diets except 'Full,' and 'Mixed.' But stimulants and eggs may be given with any diet.

3. The meat in the various diets should weigh in its raw state, exclusive of bone, the amount specified in the diets. If meat is issued with bone, 4 oz. per lb. should be allowed.

4. Each hopper should weigh 2 oz.

5. Medical officers may, in exceptional cases, diet patients on extras alone.

Time Table of Diets for European Patients.

Spoon.	Milk.	Half.	Mixed.	Full.
Early Morning Breakfast, 6 or 6–30 a.m.				
Tea or Coffee 1 pt.	Hoppers ... 2 no. Tea or Coffee 1 pt.	Hoppers ... 2 no. Tea or Coffee ... 1 pt.	Hoppers ... 2 no. Tea or Coffee 1 pt.	Hoppers ... 2 no. Tea or Coffee ... 1 pt.
Breakfast, 9–30 or 10 a.m.				
Arrowroot Conjee ... 1 pt.	Milk ... ... 1 pt. Bread ... ... 8 oz. Butter ... ... 1 ,,	Bread ... ... 12 oz. Butter ... ... 1 ,, Mutton or Chicken ... 5 ,, Potatoes ... 4 ,,	Hoppers 4 no. Bread ... ... 8 oz. Butter ... ... 1 ,, Mutton Chops. 4 ,,	Bread ... 12 oz. Mutton ... 6 ,, Potatoes ... 4 ,, Vegetable ... 4 ,,
Dinner, 2 p.m.				
Arrowroot Conjee ... 1 pt.	Milk ... ... 1 pt.	Mutton or Chicken ... 5 oz. Potatoes ... 4 ,,	Rice ... ... 8 oz. Mutton ... 4 ,, Vegetable ... 6 ,,	Mutton ... 6 oz. Potatoes ... 4 ,, Vegetable ... 4 ,,
Supper, 5–30 or 6 p.m.				
Tea or Coffee ... 1 pt.	Bread ... ... 4 oz. Tea or Coffee ... 1 pt.	Bread ... ... 4 oz. Tea or Coffee ... 1 pt.	Bread ... ... 4 oz. Tea or Coffee ... 1 pt.	Bread ... ... 4 oz. Tea or Coffee ... 1 pt.

Formulæ for preparation of Extra Diets.

1. Arrowroot blanc mange—

Arrowroot	oz.	1
Sugar	,,	1
Lime	no.	1
Milk	pt.	1
Ice	lb.	½

2. Arrowroot conjee, per pint—

Arrowroot	oz.	½
Sugar	,,	½
Milk	,,	3

3. Arrowroot jelly—

Arrowroot	oz.	1½
Sugar	,,	1
Egg	no.	1
Milk	oz.	2

4. Barley water, 1 pint—

Barley	oz.	2
Sugar	,,	1

5. Beef-juice, 1 lb.—

Hydrochloric acid	drops.	40
Salt	oz.	¼

or prepare as follows:—Mince the beef and put in a jar adding 60 grains of salt to one pound of beef, cover the jar with paste and leave it in hot water near fire for three hours and then strain the juice with a clean piece of muslin.

6. Beef-tea, 1 pint—

Beef, without bone.	oz.	12
Salt	grs.	60
Pepper	,,	10

7. Beef-tea, jugged—

Beef	oz.	16
Salt	grs.	60
Pepper	,,	20

Water sufficient to just cover meat when placed in jar. To be jugged for three hours.

8. Blanc mange—

Gelatine	oz.	1
Sugar	,,	1
Lime	no.	1
Ice	lb.	½
Eggs	no.	2
Milk	pt.	1

9. Bran-biscuits, 1 lb.—

Bran	oz.	16½
Salt	,,	
Ghee	,,	2

10. Bread-pudding—

Bread	oz.	4
Sugar	,,	1
Eggs	no.	2
Milk	oz.	15

11. Chicken, boiled—

Chicken, no. 1	oz.	10
Salt	grs.	60
Flour	oz.	1

12. Chicken broth, 1 pint—

Chicken, no. 1	oz.	10
Barley	,,	¼
Salt	grs.	60

13. Chicken curry—

Chicken, no. 1	oz.	10
Ghee	,,	½
Curry-powder	,,	½
Tamarind	,,	¼
Onions	,,	½
Salt	grs.	60
Cocoanut	oz.	3

14. Chicken cutlets—

Chicken, no. 1	oz.	10
Ghee	,,	1
Salt	grs.	30
Onions	oz.	½

15. Chicken fricasee—

Chicken, no. 1	oz.	10
Milk	pt.	½
Onions	oz.	1
Salt	grs.	60
Pepper	,,	10
Butter	,,	1
Cornflour	,,	½

16. Chicken, grilled—

Chicken, no. 1	oz.	10
Ghee	,,	1
Salt	grs.	60
Pepper	,,	30

17. Chicken jelly—

Chicken, no. 2	oz.	20
Sugar	,,	1
Lime	no.	1
Eggs	,,	2
Ice	lb.	1

Formulæ for preparation of Extra Diets—cont.

18. Chicken kusee—

Chicken, no. 1 ...	oz.	10
Rice	,,	2
Onions	,,	½
Salt	grs.	60
Pepper	,,	10
Ghee	oz.	½

19. Chicken pepper-water, 1 pint—

Chicken, no. 1 ...	oz.	10
Curry-powder ...	,,	½
Ghee	,,	½
Salt	grs.	60
Tamarind	,,	½
Lime	no.	1
Cocoanut	oz.	3

20. Chicken stew—

Chicken	no.	1
Ghee	oz.	1
Flour	,,	1
Onion	oz.	½
Spice	,,	30
Salt	grs.	120

21. Cocoa, 1 cup—

Cocoa	oz.	1
Milk	pt.	1
Sugar	oz.	½

22. Coffee, with milk, 1 pint—

Coffee powder ...	oz.	7
Sugar	,,	½
Milk	,,	2

23. Cornflour blanc mange—

Cornflour	oz.	1
Sugar	,,	1
Lime	no.	1
Ice	lb.	2
Milk	pt.	1

24. Cornflour conjee—

Cornflour	oz.	½
Sugar	,,	½
Milk	,,	3

25. Cornflour pudding—

Cornflour	oz.	2
Sugar	,,	1
Eggs	no.	2
Milk	oz.	15
Spice-powder ...	grs.	20

Native. European.

26. Curry-powder—

Chillies ...	lb.	3	lb.	1
Black pepper	oz.	10	,,	½
Coriander ...	lb.	6	,,	8
Turmeric ...	oz.	10	,,	2
Cummin-seed	,,	10	,,	1
Mustard ...	,,	10	,,	½
Vendium ...	,,	10	,,	¾
Garlic ...	,,	3	...	
Dry ginger ..		...	lb.	½
Poppy seeds		...	,,	½

27. Custard—

Milk...	pt.	1
Sugar	oz.	1
Eggs	no.	2

28. Eggs, fried—

Egg	no.	1
Ghee...	oz.	¼
Salt	grs.	30
Pepper	,,	1

29. Eggs, omelette—

Eggs	no.	2
Onions	oz.	½
Ghee	,,	1
Green chillies ...	grs.	60
Salt	,,	1

30. Eggs, poached—

Egg	no.	1
Butter	grs.	60
Bread for toast ...	oz.	1
Salt	grs.	30

31. Fish, boiled—

Fish	oz.	8
Pepper	grs.	10
Salt	grs.	30
Cornflour	oz.	½

32. Fish, fried—

Fish	oz.	8
Ghee	,,	1
Flour	,,	1
Salt	grs.	30
Turmeric	oz.	¼

33. Fish moli—

Fish	oz.	8
Ghee	,,	1
Flour	,,	1
Cocoanut	,,	2

Formulæ for preparation of Extra Diets—cont.

33. Fish moli—*cont.*

Lime	no.	1
Green chillies	dr.	½
Ginger	,,	¼
Onions	,,	¼

34. Fruit, stewed—

Fruit	oz.	8
Sugar	,,	2

35. Ginger tea, 1 pint—

Ginger	oz.	½
Sugar	,,	¼
Milk	,,	2

36. Lime-juice, 1 pint—

Limes	no.	2
Sugar	oz.	¾

37. Lime pudding—

Eggs	no.	4
Sugar	oz.	1
Butter	,,	½
Limes	no.	3

38. Linseed tea—

Linseed	oz.	1
Sugar	,,	½
Milk	,,	2

39. Mutton broth, 1 pint—

Mutton with bone	oz.	12
Barley	,,	¼
With sufficient water to produce 16 oz.		
Pepper	grs.	10
Salt	,,	60

40. Mutton chops—

Mutton	lb.	1
Ghee	oz.	1
Pepper	grs.	60
Salt	,,	60

41. Mutton chops, boiled—

Mutton	oz.	8
Ghee	,,	½
Pepper	grs.	10
Salt	,,	30
Onions	oz.	1
Barley	,,	½

42. Mutton curry—

Mutton	oz.	8
Ghee	,,	½
Curry-powder	oz.	½
Tamarind	,,	¼
Onions	,,	½
Salt	grs.	30
Cocoanut	oz.	3

43. Mutton cutlets—

Mutton	oz.	8
Salt	grs.	60
Ghee	oz.	½
Onions	,,	½
Pepper	grs.	30

44. Mutton, fried—

Mutton	oz.	8
Ghee	,,	1
Salt	grs.	30

45. Mutton, minced—

Mutton	oz.	8
Ghee	,,	1
Salt	grs.	30
Pepper	,,	10
Mint and parsley.	,,	30

46. Mutton pepper-water—

Mutton	oz.	12
Curry-powder	,,	½
Ghee	,,	⅓
Onions	,,	1
Salt	grs.	60
Lime	no.	1
Pepper	grs.	60
Cocoanut	oz.	3

47. Mutton stew—

Mutton	oz.	8
Ghee	,,	1
Flour	,,	¼
Onions	,,	¼
Salt	grs.	30
Pepper	,,	30

48. Oatmeal conjee—

Oatmeal	oz.	2
Milk	pt.	1
Sugar	oz.	2

49. Pepper-water, 1 pint—

Chillies	oz.	½
Pepper	,,	¼
Garlic	drs.	20
Tamarind	oz.	½
Salt	drs.	½

Formulæ for preparation of Extra Diets—cont.

50. Pigeon roast—

Pigeon	no.	1
Ghee	oz.	½
Pepper	grs.	10
Salt	,,	30
Milk	oz.	3
Bread	,,	1

51. Pigeon stew—

Pigeon	no.	1
Ghee	oz.	1
Flour	,,	½
Onions	,,	¼
Pepper	grs.	10
Salt	,,	30

52. Potatoe cutlets—

Potatoes	oz.	8
Ghee	,,	1
Salt	grs.	60
Onions	oz.	¼
Pepper	grs.	10
Wheatflour ...	oz.	1
Mutton	,,	8

53. Rabbit—Same formulæ as for chicken broth, chicken stew and chicken curry. Backs and legs the best parts for stewing or curry; the coarser parts to be used for roast.

54. Rice, conjee-water—

Rice	oz.	2
Salt	grs.	60

55. Rice pudding—

Rice	oz.	2
Sugar	,,	1
Milk	,,	15
Eggs	no.	2

56. Sago conjee—

Sago	oz.	½
Sugar	,,	½

57. Sago jelly—

Sago	oz.	2
Sugar	,,	½
Milk	,,	2

58. Sago pudding—

Sago	oz.	
Sugar		1
Eggs	no.	2
Milk	oz.	15

59. Scotch broth—

Beef or mutton ...	oz.	12
Salt	grs.	60
Vegetable	oz.	4
Barley	,,	½

60. Sheep-trotter jelly—

Sheep-trotters ...	no.	8
Water	pts.	2
Sugar	oz.	2
Limes	no.	3
Eggs	,,	2
Ice	lb.	1
Sherry	oz.	1½

61. Sheep-trotters stew—

Sheep-trotters ...	no.	8
Pepper	grs.	10
Salt	,,	60
Ghee	oz.	½

62. Soojee conjee—

Soojee	oz.	½
Sugar	,,	½

63. Soojee jelly—

Soojee	oz.	2
Sugar	,,	½
Milk	,,	6

64. Soojee pudding

Soojee	oz.	2
Sugar	,,	1
Eggs	no.	2
Milk	oz.	15

65. Spice powder—

Ginger in powder.	oz.	2¾
Cinnamon powder.	,,	½
Nutmeg	,,	½
Cloves	,,	¼

66. Tapioca conjee—

Tapioca	oz.	½
Sugar	,,	½

67. Tapioca pudding—

Tapioca	oz.	2

Formulæ for preparation of Extra Diets—cont.

67. Tapioca pudding—*cont.*

Sugar	oz.	1
Milk	,,	15
Eggs	no.	2

68. Tea—

Tea	oz.	¼
Sugar	,,	½
Milk	,,	2

69. Teal roast—

Teal	no.	1
Ghee	oz.	½
Pepper	grs.	10
Salt	,,	30
Lime	no.	1

70. Vegetable curry—

Vegetable	oz.	4
Curry-powder	,,	¼
Tamarind	,,	¼
Onions	,,	¼
Salt	,,	½

71. Vermicelli pudding—

Vermicelli	oz.	2
Milk	pt.	1
Sugar	oz.	1
Eggs	no.	2
Nutmeg	oz.	¼

72. Wheat-cake, each—

Wheatflour	oz.	2
Ghee	,,	½
Sugar	,,	½

The following selected recipes will also be found useful :—

IMPERIAL DRINK.

Take ½ oz. of cream of tartar, the juice of one lemon, and two table spoonfuls of sifted white sugar. Put the whole in a jar, and pour over them one quart of boiling water cover till cold. A useful drink in fevers.

BARLEY WATER.

Wash 2 oz. of pearl barley well with cold water, and reject the washings. Then boil in a pint-and-a-half of water for twenty minutes in a covered vessel and strain. The liquid may be sweetened and flavoured with thinly-cut lemon peel, which may be introduced during the boiling.

LEMONADE NO. I.

Pare the rind from a lemon thinly,and cut the lemon into slices. Put the peel and sliced lemon into a jug, with an ounce of white sugar, and pour over them a pint of boiling water. Cover the jug closely, and when cold strain.

LEMONADE NO. II.

Rub two or three lumps of sugar on the rind of a lemon, express the juice, and add three-quarters of a pint of cold or iced water, or a bottle of soda water.

EGG AND BRANDY.

Take 4 oz. each of brandy and cinnamon water, the yolk of two eggs, and ½ oz. of white sugar. Rub the yolks and sugar together, then add the cinnamon water and brandy.

MILK, EGG AND BRANDY.

Scald some new milk, but do not let it boil. (It ought to be put into a jug, and the jug should stand in boiling water). When the surface looks filmy, it is sufficiently done, and should be put away in a cool place in the same vessel. When quite cold, beat up a fresh egg with a fork in a tumbler, with a lump of sugar, beat quite to a froth, add a dessertspoonful of brandy, and fill up the tumbler with scalded milk.

MILK AND ISINGLASS.

Dissolve a little isinglass in water, mix it well with half a pint of milk, then boil the milk, and serve with or without sugar as preferred.

ENEMA OF MEAT AND PANCREAS.

Mince fine from 5 to 10 oz. of meat, and mix it with one-third of its weight of finely-chopped pancreas free from fat. Beat the mixture into a paste with a pestle or spoon, adding a little lukewarm water to make it of a suitable consistence for injection through the enema tube. Use warm; if cold it may excite the rectum and cause expulsion. A syringe with a wide nozzle must be used.

PEPTONISED MILK.

A pint of milk is diluted with a quarter of pint of water, and heated to a temperature of about 140° Fahr. Should no thermometer be at hand, the diluted milk may be divided into two equal portions, one of which is heated to the boiling point, and added to the cold portion, when the mixture will be of the required temperature. Two teaspoonfuls of the liquor pancreaticus and ten grains of bicarbonate of soda are then added to the warm milk. The mixture is poured into a covered jug, and the jug is placed in a warm situation under a 'cosey' in order to keep up the heat. At the end of an hour or an hour and a half the product is boiled for two or three minutes. It can then be used like ordinary milk.

Peptonised Gruel.

Gruel may be prepared from any of the numerous farinaceous articles in common use, viz., wheaten flour, oatmeal, arrowroot, sago, pearl barley, pea or lentil flour. The gruel should be well boiled, and made thick and strong. It is then poured into a covered jug, and allowed to cool until it becomes lukewarm. Liquor pancreaticus is then added in the proportion of a dessertspoonful to the pint of gruel, and the jug is kept warm under a 'cosey'. At the end of a couple of hours the product is boiled and strained.

* Peptonised Milk Gruel.

First a thick gruel is made from any of the farinaceous articles mentioned under recipe 32. The gruel, while still boiling hot, is added to an equal quantity of cold milk. The mixture will have a temperature of about 125° Fahr. To each pint of this mixture two or three teaspoonfuls of liquor pancreaticus and ten grains of bicarbonate of soda are added. It is kept warm in a covered jug under a 'cosey' for an hour or an hour and a half, and then boiled for two or three minutes and strained. If the product has too much bitter flavour, a smaller quantity of the liquor pancreaticus must be used in the next operation.

* Peptonised Beef Tea No. I.

A pound of thinly-minced lean beef is mixed with a pint of water, and ten grains of bicarbonate of soda are added thereto. The mixture is then simmered for an hour and a half in a covered saucepan. The resulting beef tea is decanted off into a covered jug. The undissolved beef residue is then beaten up with a spoon into a pulp, and added to the beef tea in the covered jug. When the mixture has cooled down to about 140° Fahr., (or when it is cool enough to be tolerated in the mouth) a tablespoonful of the liquor pancreaticus is added, and the whole well stirred together. The covered jug is then kept under a 'cosey' for two hours, and agitated occasionally. At the end of this time the contents of the jug are boiled briskly for two or three minutes and finally strained. The product is then ready for use.

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* The peptonised milk gruel or peptonised beef tea mixed with some soluble carbo-hydrate, such as maltine, or a mixture of one of the malted foods and peptonised milk, are useful preparations for rectal alimentation. Small quantities of wine or brandy may be added to such enemata when stimulation is indicated.

* Peptonised Beef Tea No. II.

Finely mince ½ lb. of lean beef, mix with a pint of water, and allow to simmer for an hour; let it then cool to lukewarm and add one Fairchild's peptonising powder †: set aside for three hours but stir occasionally; at the end of this time strain off the liquid portion and boil for rather less than a minute; serve hot, and season with salt to taste.

Peptonised Enemata.

To a mixture of milk and gruel, or milk, gruel and beef tea, add a dessertspoonful of liquor pancreaticus before administering as an enema.

☞ Note.—In the above peptonised preparations the times given are approximate; the development of a faintly bitter taste is the real test as to whether the action has gone far enough. If after this is noted the action is allowed to go on, the food becomes still more bitter and often very unpalatable. Remember that all action is at once arrested by boiling the food.

GENERAL RULES REGARDING DIETS AND EXTRAS.

Administrative.

1. The non-storable articles composing the various diets and extras will be ready at the morning visit for the inspection of the Medical officer.

2. The Medical officer, without giving any previous warning, should visit the hospital occasionally for the purpose of ascertaining whether the sick get the full quantities of the articles ordered, as well as for inspecting the meal.

3. The dinners are invariably to be served in the presence of the Stewards.

4. The tea should be infused (not boiled) in the presence of one of the Stewards, a cauldron being exclusively reserved for the purpose.

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* The peptonised milk gruel or peptonised beef tea mixed with some soluble carbo-hydrate, such as maltine, or a mixture of one of the malted foods and peptonised milk, are useful preparations for rectal alimentation. Small quantities of wine or brandy may be added to such enemata when stimulation is indicated.

† A tube of Fairchild's zymine or peptonising powder is equivalent to about three teaspoonfuls of Benger's liquor pancreaticus and 15 grains of bicarbonate of soda.

5. The cows from which the milk is supplied will be brought to the hospital, morning and evening, and milked, under the supervision of the Stewards. The milk will be put at once into clean cans and locked up till handed over to the cook for boiling, after which it will be again placed in the same cans and served out.

6. Printed copies of the diet scales will be hung up in a conspicuous place in each ward or hut.

7. Each pint of milk to consist of 20 oz.

Each unit of measure of tea to consist of 13 oz., inclusive of milk.
Each unit of measure of conjee to consist of 10 oz.
Each unit of measure of broth to consist of 16 oz.
Each unit of measure of jug-broth to consist of 8 oz.

* * * *

9. Milk should always be boiled before issue to patients.

10. The quality of butter may be generally determined by the taste. When melted in a test tube, the water and the casein below the oil ought not to exceed 15 per cent.

11. A good and fresh egg should weigh 2 oz.

12. Ghee may be tested by taste and smell. It is most commonly adulterated with gingelly oil or other fixed oil, plantains or fats.

13. Good beef or mutton may be distinguished by appearance and smell; the fat should be fine and white, the flesh close ground and of a bright red colour, the inside of the leg of a sheep well formed and plump. The feet of the sheep should be attached when the mutton is being passed by the Medical officer.

14. Beef tea and all broths may be ordered 'jugged' when the total quantity of the pint will not exceed 8 oz., and meat, bones, &c., will be strained from the broth.

15. No broth or soup should be sent from the kitchen with grease on them.

16. In the General Hospital 51 oz. by weight or 64 by measure is the outturn of a pound of raw rice when boiled.

17. The salt used for all diets should be of the quality known as 'good white.'

18. The following country vegetables should be used to vary the diets for which country vegetables are ordered:—Potatoes, sweet potatoes, brinjals, bundaikai, pumpkins, country spinach, Goa potatoes, drumsticks, yams, country beans, country asparagus and spinach.

19. Children under 5 years are to be placed on extras as required. Those between 5 and 8 on 'half'; between 8 and 14 on 'two-thirds' quantity of any diet allowed for adults.

20. All wines and spirits ordered for patients are to be sent before noon to the Nurse in charge of the ward in corked bottles properly labelled.

INSTRUCTIONS TO MEDICAL OFFICERS REGARDING THE DIETETIC MANAGEMENT OF THE SICK IN THE GOVERNMENT CIVIL HOSPITALS IN THE PRESIDENCY TOWN.

1. The attention of Medical officers is called to appendix No. 3, page 273, Volume VI, Army Regulations, India, regarding the principles which ought to guide them in selecting the diets most suitable for particular classes of cases, and in avoiding unsuitable food.

2. Medical officers are reminded that from 25 to 30 grains of carbon and from 1 to 1·5 grains of nitrogen for every pound of body weight is calculated as sufficient to maintain health and vigour in a European—vide *Dr. Tidy's Legal Medicine, Part I, page 275.* Moleschel states that the following quantities of each of the alimentary groups are necessary to maintain in health an adult European under moderate labour:—

Albuminates	4·4 ounces.
Carbo-hydrates	14 do.
Fat	2·75 do.
Salts	437 grains.

Total water free food requires 22 ounces, or

Nitrogen	300 grains.
Carbon	5,000 do.

The following are the number of grains of nitrogen and carbon contained in a pound of different articles of diet:—

	Nitrogen.	Carbon.
Beef, cooked	304	1,854
Bread, average	88	1,975

	Nitrogen.	Carbon.
Butter	0·2	6,456
Buttermilk	44	387
Egg	149	1,144
Fish	195	871
Milk, fresh	44	599
Mutton, cooked	304	1,883
Oatmeal	136	2,831
Peas, dhall	248	2,699
Potatoes	22	769
Rice	68	2,732
Sago	13	2,555
Sugar	..	2,955
Vegetables, green	14	420
Wheat flour	116	2,700
Whey	13	154

3. The attention of Medical officers is called to the fact that the practice of most of the hospitals in the Presidency town shows that Europeans can be properly dieted at an annual average daily rate not exceeding 8 and Natives at an average cost not exceeding 4 annas, without unduly curtailing the discretionary powers of Medical officers in prescribing such diets and extras as they consider necessary. When these figures are exceeded, a report, justifying the excess, will have to be submitted to the Surgeon-General with the Government of Madras.

4. The bed-head diet tickets should be written up daily; where no extras are ordered, the blank columns should be scored through and the sheet initialled on the date the patient is discharged, or on the last day of the month.

5. When extras are ordered they should be entered in words, any blank columns should be scored through, and the daily entries initialled by the Medical officer.

6. All unauthorized articles require the special sanction of the Surgeon-General. The necessity for such articles should be very rare.

7. All special orders regarding the cooking of diets must be endorsed on the diet sheets.

8. Each Medical officer will be provided with a printed copy of these rules on joining any of the hospitals in the Presidency town.

9. When the contractor's rates are published by the Surgeon-General, each Medical officer will be provided with a card showing cost of diets, extras and stimulants for the year.

Nutritive value as shown by the Nitrogen and Carbon contained in each diet for European and East Indian Patients.

Spoon.	Milk.	Half.	Mixed.	Full.
Grs.	Grs.	Grs.	Grs.	Grs.
Nitrogen 12	Nitrogen 160	Nitrogen 300	Nitrogen 260	Nitrogen 340
Carbon 664	Carbon 3,771	Carbon 4,673	Carbon 5,100	Carbon 6,000

(Calculated by Surgeon T. H. Pope, Assistant Physician, General Hospital.)

Nutritive value as shown by the Nitrogen and Carbon contained in each diet for Native Patients.

Diets.	Nitrogen.	Carbon.
	Grs.	Grs.
Spoon	1	331
Milk and bread	150	3,027
Milk and rice	130	3,597
Coffee	80	1,914
Half	134	3,160
Full and bread	280	4,150
Full and rice	250	4,860

(Calculated by Surgeon T. H. Pope, Assistant Physician, General Hospital.)

NOTE ON MILK, TYRE, WHEY, BUTTERMILK, AND BUTTER.

Milk.—Good pure cow's milk has a sp. gr. of 1,025 to 1,035, and milk below 1,025 should be rejected.

Skimming of the cream increases the sp. gr. about 2°. Every increase of 10 per cent. of water lowers the sp. gr. about 3°. Buffalo's milk is a little richer than cow's milk, but they do not differ very materially.

Milk should have no unpleasant odour or taste, and exhibit no deposit on standing.

Tyre, as sold in the bazaars, is usually mixed with about 50 per cent. of water.

Its purity may be judged to some extent by its thickness. Pure tyre has a sp. gr. rather higher than that of milk, owing to evaporation of water during boiling.

Its sp. gr. cannot be determined by the sp. gr. flask, owing to disengagement of gas bubbles during fermentation, nor by a hydrometer, owing to its thickness.

The following method, however, has been found to give reliable results :—

Apparatus.—A urinometer or lactometer, the accuracy of, or necessary correction for, which may be sufficiently ascertained by floating it in distilled water.

Alkaline solution prepared by adding Liq. potassæ to water, frequently stirring, until the sp. gr. of the solution is exactly 1,010.

Test.—The tyre (or buttermilk) having been well stirred or shaken, a carefully measured portion of it is mixed with an equal volume of the alkaline solution, and the mixture is agitated until the curds are completely dissolved. Its sp. gr. is then taken, and, after deducting 5 (sp. gr. due to potash), the excess over 1,000 is doubled.

The result thus obtained is the sp. gr. of the uncurdled milk, and it is a fair index of the proportion of water which has been added.

EXAMPLE.—Sp. gr. of tyre and potash mixture	1,021
Deduct for potash	5
	1,016
Double for dilution	2
Sp. gr. of tyre	2,032

If 1,025, (or any other standard) be fixed as the minimum sp. gr. for tyre, a very simple method of using this test, without any measuring, would be by the employment of a caustic potash solution of sp. gr. 1,025 (or other standard). If this were mixed in any proportion with the tyre, the sp. gr. of the mixture should never fall below the standard. The following is a ready method of applying the test :—*Shake* *up a portion of the tyre in a bottle, adding by degrees sufficient standard potash solution (sp. gr. 1,025) to dissolve the curds. The sp. gr. of the mixture should be at least 1,025.*

Whey.—The sp. gr. of whey is 4 or 5 less than that of pure milk. Whey may be rapidly separated from the curd of tyre by straining through muslin, and its sp. gr. may be taken as an index of the purity of the tyre; but as the casein is thus estimated indirectly only, the potash solution test appears preferable.

Buttermilk from the bazaars often has a sp. gr. of about 1,008, indicating a proportion of about 7 parts of water to 3 of milk. Allowing for the addition of a fair proportion of water, which is usually added during churning, the sp. gr. of buttermilk ought not to sink below 1,014.

The sp. gr. of buttermilk may be ascertained in the same manner as that of tyre. For a ready test, the potash solution should be diluted with water to a sp. gr. of 1,014 (or other standard) and be employed in the same way as in the examination of tyre.

Since it is likely that bazaar milk, buttermilk, and tyre may be contaminated by impure air, hand, and vessels, as well as by impure water, it is advisable that they should always be boiled before use.

Butter frequently contains a large excess of water, and casein. When melted in a test tube the water and casein below the oil ought not to exceed 15 per cent.

PRINCIPLES WHICH OUGHT TO GUIDE THE MEDICAL OFFICER IN SELECTING THE DIETS MOST SUITABLE FOR PARTICULAR CLASSES OF CASES, AND IN AVOIDING UNSUITABLE FOOD.

APPENDIX NO. 3, I.A.R., VOL. VI, MEDICAL.

1. There are several preliminary points to be considered before finally deciding upon any fixed diet for a particular case. Hence it is usual to put a patient on first admission to hospital upon a low diet, *i.e.*, upon a bare subsistence diet in a quiescent state, until one suited to his ailment is prescribed after sufficient examination of the case.

2. The first points to determine are, what can the patient take? What kind of food—as between fluid and solid food

—is most suitable? Is fever present or absent? Do the skin and kidneys act freely?

3. In every case of grave illness, the amount of urine passed in the 24 hours should be measured, its specific gravity taken, and the solids (at least) estimated. It is also desirable to estimate the daily amount of urea excreted in the urine, and to estimate and represent the total free acidity in the usual way.

4. The nature of the food exerts a marked influence upon the urine, and the kidneys perform an eliminative office, the efficiency of which cannot be estimated unless the daily renal excretion is measured. Fats and carbo-hydrates throw no immediate work upon the kidneys. It is through the nitrogenous ingesta that the kidneys are taxed, by the elimination of nitrogenous products, which furnish the chief parts of the solids of the urine. Hence the necessity of ascertaining at the outset the adequacy or inadequacy of the renal function.

5. If the kidneys are implicated, or any renal inadequacy exists,—as indicated by the examination of the urine—the work of the kidneys may be lightened by so arranging the diet as to lessen the amount of nitrogenous aliment to what is absolutely needed (and no more) to sustain life, and allowing vegetable food to predominate.

6. The re-action of the urine may also be influenced by diet. Animal food increases acidity, vegetable food diminishes it, and may even produce alkalinity. Thus preponderance of vegetable food in the diet diminishes both the amount of solids and of free acid eliminated by the kidneys—a condition to be desired by those in whom red sand and solids abound unduly in the urine. On the other hand, where alkalinity prevails or earthly phosphates are deposited, a meat diet should preponderate, except where urine is alkaline from ammonia.

7. In dealing with diseases of the digestive organs, more is to be done by dieting than by drugs, and without attention to diet, drugs will rarely give relief. The power of mastication possessed by the patient must be especially inquired into. If teeth are deficient, or if the jaws cannot be moved, food cannot be masticated, and should therefore either be liquid or sufficiently minced so as to be easily swallowed with fluids. The food ought to be given at regular intervals, and the amount that can be taken at a time

should regulate the frequency of taking it. The smaller the amount taken at once, the more frequent should be its administration, and an interval exceeding four or five hours without food is to be avoided.

8. In febrile, acute inflammatory and other conditions where an absence of digestive power in the stomach prevails, it is not only useless to give solid nitrogenous food, but absolutely hurtful. The following articles should predominate—beef-tea, mutton, veal, or chicken broth; whey, calf's foot and other kinds of jelly; arrowroot, gruel, barley-water, rice-water, fruit jellies, fruit juice, such as lemons or oranges made into drinks. In some cases milk, or eggs, in a raw condition, beaten up with milk; also bread jelly (made by steeping bread in boiling water and passing through a sieve when still hot,) either alone or boiled with milk, may be given, and, as circumstances dictate, an advance to more solid food may be made (during convalescence from enteric and other fevers) to puddings of rice, sago, tapioca, bread, or custard. A diet of fish may next be allowed, either boiled or broiled, but not fried. As digestive powers improve, calf's feet, chicken, or mutton may be allowed; but if given too early in convalescence, a relapse of febrile phenomena may be induced.

9. If it is impossible to introduce food of any kind into the stomach, life may still be sustained by the use of nutritive enemata, such as concentrated beef-tea with eggs, milk, or gruel.

10. In acute gastritis and ulcer of stomach, the diet should consist of boiled milk, allowed to get cold, milk and lime-water, or milk and soda-water. The milk may also be thickened with isinglass, arrowroot, or ground rice.

11. In dyspepsia the principle of management should be to keep the diet as much as possible to what is natural and sufficient, and to avoid reducing the patient to the use of fluid food only. If fluid food is continuously given, the powers of the stomach are thereby weakened, and the system is insufficiently nourished. The food must be simple and plainly cooked. Of meat diets, mutton (old, lean and brown, rather than young, fat and pale) is the most suitable; also chicken; also stale bread, dry toast, floury potatoes, rice and farinaceous articles of food. Anything containing fatty matter which has been baked, or fat which has been exposed to a very high temperature, is objectionable. Hence pastry and fried articles must be avoided; also dishes consisting

of meats cooked a second time. Anything turned rancid by keeping, such as butter, may also upset the stomach and cause heartburn. Starchy and sugary articles may sometimes be obnoxious to the stomach, producing acidity and acid eructations (acid dyspepsia). Oatmeal and potatoes seem the most, and rice the least, disposed to be obnoxious in this respect. Cases of heartburn, itching of the skin, bronchial catarrh, irritability of urinary passages, acute dyspepsia, stomach-pain, cramp, vomiting or diarrhœa, skin diseases (such as lepra, psoriasis, eczema), are all direct manifestations of an over acid state of the system to be inquired into by an examination of the amount of free acid in the urine passed in the course of 24 hours.

12. Palpitations, fluttering of the heart, exaggerated pulsation of the large arteries, irregularities and intermissions of the pulse, aching pains in the limbs, burning patches, itchy patches, megrim, vertigo, noises in the ears, sleeplessness, and the like, often ascribed to the liver or to gout, may be also ascribed to an accumulation of acid in the system, and suggest careful dieting in accordance with the urine indications. In all such cases the intervals between meals must not be too prolonged, and small quantities of food are to be taken at a time. A little food should be taken the last thing at night, and immediately on waking in the morning; alcohol and coffee are to be avoided.

13. Constipation, diarrhœa, flatulence, colic, show that the bowels are in a condition in which they are influenced in a marked manner by different kinds of food. Eggs have a tendency to favour constipation. Succulent vegetable food (fruit or vegetables) encourage alvine evacuations, promoting a loose state of the intestinal canal. Such kind of food is indicated when a costive habit prevails; and fruit eaten in the early part of the day may succeed in securing a proper activity of the bowel functions. On the other hand, where looseness prevails, such food is contra-indicated, unless the scorbutic diathesis be present.

14. Leguminous seeds (peas, beans, &c.) are the most prone to give rise to flatulent dyspepsia. In flatulent dyspepsia, the urine has its normal acidity decreased. It may be neutral or alkaline, in severe cases it persistently deposits oxalates with carbonates of the fixed alkalies (potash and soda). In such cases the food must be well masticated—the teeth must be looked to—the meat must be tender, easy of digestion, and well cooked. The meals must be taken

regularly, and intervals of abstinence not too prolonged, not more than four hours, and not much food at a time. Alcohol and coffee are to be avoided. Fluid is to be taken in small quantity at meal times, and aèrated waters avoided. Fluids are best taken two hours after meals.

15. In dysentery and enteric fever, scrupulous attention must be given to dieting. The intestines must be kept in as tranquil a state as possible. The food must be the least stimulating and irritating to the mucous surfaces and muscular fibres. Milk alone, or milk with isinglass, or with beef-tea, chicken broth, raw meat juice, cream, and barley-water, and the various peptonised foods, especially rice, are the most valuable. Next to these are eggs beaten up in milk or in whey; ice and iced drinks are very grateful. As convalescence advances, white fish, white-fleshed poultry, and mutton may be gradually allowed, as already indicated. Salted and dried meats are to be prohibited, and also fruit and succulent vegetables, unless the scorbutic diathesis be present. But if these latter are not admissible from any cause, then lime-juice will be frequently required as a dietetic drink in the daily allowance of water, in order to counteract the otherwise inevitable tendency to scorbutus.

16. To guard against scurvy is a point of great importance in dietetics. Patients are often kept for weeks on a diet from which the vegetable elements are either excluded or do not enter in sufficient quantity; the result is the disease under which the patient labours *plus* scurvy.

17. Meat alone is unwholesome, if taken without vegetables for any length of time. Beef-tea will be taken by patient when they refuse all other kinds of food. This is especially the case in the febrile state generally. It has a certain sustaining power, apart from any nutrient value, which latter it does not possess in any marked degree, unless other aliments are added to it, such as arrowroot, or flour of wheat, oats or barley. Such combinations seem to acquire a nutritive power out of all proportions to the solids they contain. Milk and the preparations of milk are the most important articles of food for the sick. Butter is the lightest of animal fats (milk fat). It enables the patient to enjoy his bread. All preparations made from flour of wheat, oats, groats or grits, and barley, are to be preferred to any and every preparation of arrowroot, sago, tapioca, corn-flour, semolenta and their kind. Cream in long chronic ailments cannot be surpassed. It contains 26·7 per cent. of milk fat. It is easier of digestion than milk, and seldom disagrees,

18. The total amount of fluids (of all kinds) taken throughout the 24 hours should be carefully regulated, their quantity accurately measured, and for this purpose a table (*vide* form of Nursing report) may be of use in specially grave cases.

THE MOST APPROVED METHODS OF PREPARING AND KEEPING IN A FIT STATE THE SELECTED ARTICLES OF DIET AND EXTRAS DEEMED NECESSARY.

19. These points embrace the cooking of food. In the diet table for army hospitals (Appendix No. 4), the practice is to weigh the meat *uncooked*.

20. Meat loses in cooking, the loss varying with the quality of meat and the process of cooking. The ordinary percentage is as follows :—

—	Boiling.	Baking.	Roasting
Beef, generally	20	29	31
Mutton ,, ...	20	31	35
Legs of mutton	20	32	33
Shoulders of mutton	24	32	34
Loins of mutton	30	33	36
Necks of mutton	25	32	34
Average of all ...	23	32	34

21. But other losses are sustained, *e.g.*, for bone alone it is usual to deduct 20 to 25 per cent.; the rule in the army being to add *one-fourth* to the ration when it is issued with bone, which is equivalent to a deduction of 20 per cent. from the estimated nutritive value of the total ration. There is also some loss from the presence of indigestible tissues, such as areolar tissue and the like, but in good well-fed meat this is comparatively small.

22. The gravy and fat which drain from the meat in roasting ought to be utilised for the patients as far as possible; the gravy being served with the meat, and the fat or dripping added to the vegetables (such as cabbage or the like), or otherwise used for the cooking of the diets.

23. Food ought not to be left at the patient's bedside. Milk or beef-tea ought not to be supplied in quantity equal to a whole day's allowance at one time and so remain

to be consumed, or to be removed unconsumed after so standing for 10 or 12 hours in a ward. The due allowance for the particular diet should come at the proper time; and if not consumed within a reasonable time (say one or two hours), it ought to be removed. Milk that is sour, soup or beef-tea which is turned, bad eggs or underdone vegetables, ought never to be brought to a patient. The least change or sourness in milk makes it, of all foods, the most injurious; and, if taken by a patient, indigestion or diarrhœa is a common result. At the same time, it ought to be remembered that nothing is so absorptive of odorous vapours or volatile flavours as fats; and that milk and butter absorb and retain the odours from cheese, meat, and from every kind of vegetable or animal matter, given forth by decomposition or otherwise. If improper, strongly-flavoured food has been given to cows, the butter made from their milk will reveal the same taste and flavour.

NECESSITY ON THE PART OF MEDICAL OFFICERS OF GIVING SPECIFIC INSTRUCTIONS TO THE ATTENDANTS IN REGARD TO THE GIVING OF FOOD IN EACH CASE, AND THE BEST METHOD OF ADMINISTERING NOURISHMENT IN SEVERE CASES.

24. These points embrace the quantity of food taken at a meal, or at any particular time, the times of eating, and provision for the administration of food during the night as well as during the day.

25. The quantity of food given at any one time should be in proportion to the powers of digesting it, and to compensate for any diminution of quantity at one time, there should be corresponding increase in the frequency of administration. "*Little and often*" is the maxim in such cases. There is a want of staying power in sickness which renders it necessary to shorten the periods of abstinence from food as much as possible.

26. From 5 P.M. till 8 A.M. patients are apt to be neglected as to food, unless their feeding is specially provided for. This ought to be done by special arrangement, instructions to that effect being given to the night attendants. Weak patients may not be able to take food of any kind until well on in the forenoon, especially if suffered to fast throughout the night. For such cases a spoonful of beef-tea, or of arrowroot with wine, or of egg with milk, given every hour during the night, will afford the required nourishment, and

prevent over-exhaustion and the consequent incapacity to take such substantial diet as may be prescribed during the day. It is better to give small quantities often, than larger amounts at longer intervals, such as a cupful (5 to 10 ounces, according as a tea-cup or breakfast cup is meant) every three hours; the patient's stomach may not tolerate so much at a time—better a tablespoonful every hour, or even a teaspoonful every half-hour.

27. The food should be given punctually at the time ordered. When food is persistently declined by a patient who is very weak, the medical officer ought to ask him the question: Is there any hour or time that you fancy you can eat? and if he can so relish food, let him be tried with it at the time he names. The food that is most relished is generally most needed and best digested. Disrelish for food indicates incapacity to digest it, or at least, defective digestive capacity. The Nursing report will be useful to note down for the medical officer's information what articles and how much of them have been given by the Nurse in charge of the case.

Nursing Report.

Report of Patient *No.* *Ward.*

Time.	Temperature.	Pulse.	Respiration.	Motions.	Urine.	Dose of medicine.	Nursing treatment.	Nourishment.	Remarks.

Date *Nurse on duty.*

ALCOHOL TABLE.

The weight of absolute alcohol (sp. gr. 796 at 68° F.) and of carbon in measured quantities of spirituous liquors.

Spirituous liquors.	1 oz. avoir. Abs. Alcohol is contained in fluid ounces.	1 oz. avoir. Carbon is contained in fluid ounces.
ARDENT SPIRITS.		
Proof spirit	2·26	4·3
Whisky	2·6	5·0
Brandy	2·7	5·0
Rum	2·8	5·3
Arrack	3·0	5·8
Gin	3·2	5·5
WINES.		
Sherry	6·6	10·2
Cape Madeira	6·8	11·0
Port	6·9	10·2
Marsale	7·5	11·7
Champagne	12·6	11·3
Hock	13·4	20·4
Hungarian Red Voslau	14·1	21·2
Burgundy	15·2	23·8
Mosolle	15·2	23·3
Claret	16·3	23·4
Santerno	19·0	27·2
Hungarian White Neszwely	19·0	28·8
Cidor	64·0	40·0
MALT LIQUORS.		
Ale, Burton, Bass. ◇ 84/	12·5	9·0
„ „ „ ◈ 60/	14·2	13·0
„ Pale, „ ⟐ 0/	19·0	17·5
„ India (Gardner) × 54/	23·0	28·0
„ Bottled { Scotch (Edinb.)	19·0	13·1
Pale	25·0	20·5
„ „ Eight penny	22·7	22·2
„ Family 1/ gall.	24·9	22·0
„ „ Four penny	25·4	23·0
Stout, Dublin, bottled	28·8	16·7
„ London	21·5	18·9
Portor, London	35·6	26·6

(DOBEE'S *Diet and Regimen.*)

As a rule, the average allowance of absolute alcohol taken by a healthy adult man in twenty-four hours should not exceed from one ounce to one-and-a-half ounces, in whatever shape it is taken. (Anstie. *Practitioner*, vol. 3, p. 37.)

CHAPTER VII.

INDIGENOUS DRUGS.

The following list of indigenous drugs are easily procured in the ordinary bazaars of this Presidency in a fairly pure condition, nevertheless caution should be exercised in buying from unscrupulous dealers who are always ready to adulterate:—

Calotropis gigantea, Br.

Vernacular.—Madár, *Hind.* Erukku, *Tam.* Natural order Asclepiadeæ.

The drug consists of the root barks of *Calotropis gigantea*, Br., and *Calotropis procera*, Br. They are similar in appearance and occur in short-quilled pieces, $\frac{1}{8}$ to $\frac{1}{5}$ of an inch thick. The outer surface is yellowish grey, soft and corky, fissured longitudinally. Taste mucilaginous,bitter and acrid, and the odour peculiar.

The roots should be collected in April or May.

Preparation.—Pulvis Calotropis (powder of Mudár).

Dose.—As an alterative tonic, 3 grains, gradually increased to 10 grains or more, thrice daily. As an emetic from half a drachm to a drachm.

Properties.—Alterative tonic and emetic.

Uses.—In syphilitic cachexia, chronic rheumatism, syphilitic and idiopathic ulcerations.

In the dysentery of natives it has been highly spoken of in doses of 20 to 60 grains. It should be administered with the same precautions as with large doses of ipecacuanha.

In Southern India the dried milky juice of the plant is considered to be more efficacious, the dose being about 5 grains, thrice daily.

Gynocardia odorata, Br., Chaulmugra.

Officinal part.—The seeds (Gynocardiæ semina—Chaulmugra seeds) about an inch in length, irregularly ovoid, more or less angular or flattened by mutual pressure; they average about 35 grains in weight. Each seed has a thin brittle smooth and dull grey-coloured testa. The odour of the seed is nauseous and peculiar. They yield by expression a fixed oil which has a peculiarly unpleasant smell.

Active principle.—Gynocardic acid.

Dose.—The dose of the seed coarsely powdered is about 6 grains, thrice daily, in the form of a pill. The dose of the oil is 5 to 6 drops gradually increased; the oil obtained from the bazaars is usually impure and is, therefore, not used internally. An ointment prepared by beating the seeds deprived of their testa into a paste with as much simple ointment as is necessary to give it a proper consistence.

Uses.—In a few of the London hospitals the oil has been used for stiff joints caused by rheumatism, sprains and sciatica, the oil being rubbed into the affected joints and at the same time 4 or 5 minims of the oil was administered internally several times daily. The oil has been used with advantage in macular and anæsthetic leprosy; during the treatment bronchial affections are said to have disappeared. In dry eczema of the face and hands an ointment made with 15 to 20 grains of gynocardic acid to the ounce of vaseline has been used with success; in acute eczema the good effect is said to be not so marked. Nausea is said to be caused after a time by the internal as well as external use of the drug. During the use of this drug it is as well to avoid all salt meats, spices and sweetmeats; on the other hand, its operation is aided by butter, ghee, and oily articles of diet.

Butea frondosa, Roxb., Bengal Kino tree.

Vernacular.—Palás, Dháll, *Hind.* Murukkan-maram, *Tam.* Modugachettu, Paláshamu, *Tel.*

Officinal parts.—Gum and seeds. The inspissated juice obtained from the stem by incision; it occurs as small flattish or angular fragments, the size of a pea of a very deep ruby colour; almost opaque; it is mixed with numerous small particles of a light grey corky bark; the taste is purely astringent. Its astringency is due to tannic and gallic acids. The seeds are flat, about $1\frac{1}{2}''$ long, $1''$ broad, and $\frac{1}{16}''$ thick: testa dark reddish brown, thin, smooth, veined: hilum prominent; taste acrid. The properties of the gum are similar to kino for which it has been found an efficient substitute.

Dose.—Of the gum 10 to 30 grains:— of the seeds without testa 20 grains.

Uses.—The gum has been used in cases of chronic diarrhœa and dysentery; dissolved in water or alcohol it may be used as astringent lotions or gargles.

The seeds have been used as anthelmintics in doses of a table-spoonful and-a-half, twice daily, in cases of ascarides and tapeworm; they have a slight aperient action. When the seeds are pounded with lemon juice and applied to the skin, they act powerfully as a rubefacient and have been used successfully for the cure of the form of herpes known as dhobie's itch.

Azadirachta indica, Juss., Nim or Margosa tree.

Officinal parts.—Bark and fresh leaves. Nim bark is coarsely fibrous and varies in thickness according to the age of the tree from which it is taken. The external surface is rough, fissured, and of a rusty grey colour: the inner surface yellowish and foliaceous. The taste is bitter and astringent. The fresh leaves are pinnate, ovate, lanceolate, accuminated, unequal sided, and very bitter.

Preparations.—

Bark	ʒ i.
Decoction	Dose ℥ i to ℥ ii, freshly prepared.
Tincture	,, ʒ ss to ʒ ii.
Poultice	It is prepared by bruising a sufficient quantity of the fresh leaves with a little tepid water.

Properties.—The bark is astringent tonic and antiperiodic. The leaves are stimulant. The bark and its preparations have been found to be remedies of considerable value in intermittent fever; it should be given every second hour previous to the time at which the attack is expected to return. As a tonic it has been used in cases of convalescence after fevers, general debility and loss of appetite. The leaves are added to poultices to disperse glandular tumours, and are used generally as a discutient. They are also used in cases of indolent and ill-conditioned ulcers, especially those of long standing; should the poultice cause pain and irritation, an equal weight of rice flour may be added.

Soymida febrifuga, Juss., Rohun tree.

Vernacular.—Rohan, *Beng.* Shemmaram, *Tam.* Somidamanu, *Tel.*

Officinal part.—The bark occurs in somewhat half tubular quills, an inch or more in diameter and about $\frac{1}{5}''$ in thickness. Externally it is of a rusty grey or brown, with a smoothish surface, few cracks but numerous corky warts. The inner side and edges of the quills are of a bright reddish brown and fibrous. It has a better astringent taste, but without odour. The bark is rich in tannic acid; it also contains a bitter principle.

Dose.—Of the powdered bark ʒ i twice daily.

Preparation.—The decoction ℥ i p to a pint of water; boil for 15 minutes and strain.

Uses.—The bark has been used in those cases where astringent tonic is indicated. It is not an antiperiodic.

The decoction is well adapted for gargles, vaginal and urethral injections and enemas.

Toddalia aculeata, Pers., Toddalia.

Vernacular.—Milakaranai, *Tam.* Kondakashinda, *Tel.* Kakataddali, *Mal.*

Officinal part.—The root bark.

The bark is about $\frac{1}{12}''$ thick and consists of a soft yellow corky external layer, wrinkled longitudinally, a thin bright yellow layer, and a firm brown middle cortical layer. The fresh root bark is pungent and aromatic.

Preparations.—

Tincture	..	..	..	Dose ʒ i p to ʒ iii.
Infusion	..	..	..	,, ℥ i to ℥ ii.

Properties.—Aromatic tonic and stimulant. The infusion has been used as a stimulating tonic and carminative. The drug has decided antiperiodic and antipyretic properties, useful in simple fever.

Carum copticum, Benth., Ajwain or omum plant.

Vernacular.—Ajwain, *Hind.* Omum, *Tam.* Omamu, *Tel.*

Officinal part.—The fruit. The fruits are of the size and shape of those of parsley, of a greyish brown colour, with a tubercular surface, extremely aromatic, evolving, when rubbed, a strong odour resembling that of common thyme. Taste somewhat bitter and very pungent. Its virtues reside in a volatile oil.

Preparations.—

The oil or omum (Oleum Ptychotis)			Dose 1 to 3 drops.
Ajwain or omum water	..	..	,, ℥ i to ℥ ii.

Natives occasionally employ the bruised seeds in doses of a dessertspoonful with a little salt; this is washed down with a little water.

Properties.—A valuable stimulant, carminative and antispasmodic.

Uses.—It is a useful remedy in the diarrhœa and flatulent colic of children; in some forms of dyspepsia, in the vomiting, griping or diarrhœa arising from errors of diet; in simple flatulence and tympanites, in spasmodic affections of the bowels, and in hysteria. In cholera no reliance can be placed on it alone. It is a useful vehicle for nauseous drugs such as caster-oil. In habitual drunkenness it is said to have proved useful in relieving almost immediately the sensation of 'gnawing' or 'sinking at the pit of the stomach,' which symptoms are associated with the frequent use of spirits.

Acacia catechu, Willd., The Catechu Acacia.

Vernacular.—Kath, *Hind.* Kashukatti, *Tam.* Kanchu, *Tel.*

Officinal part.—An extract of the heart-wood. It occurs in masses, consisting of layers occasionally enveloped in rough leaves: blackish brown, shining heavy, bitter and very astringent. It contains 45 to 55 per cent. of a variety of tannin. Dose 10 to 20 grains.

Preparations.—

Infusion catechu	..	..	℥ i to ℥ ii.
Tincture catechu	..	..	ʒ ss to ʒ ii.
Pulvis catechu co	..	..	15 to 33 grains.

Properties.—Powerfully astringent.

Uses.—In the diarrhœa of children unattended with fever, about 4 grains of the powder with an equal quantity of cinnamon. As an astringent lotion or gargle it is very useful in mercurial salivation, in ulceration and sponginess of the gums, in relaxed sore throat, hoarseness, &c. In the diarrhœa of adults it may be combined with the tr. opii if necessary. The infusion is a useful lotion to flabby ulcers and may also be used as a preventative of sore nipples.

Ægle marmelos, Corr., The Bael fruit.

Vernacular.—Bíl, *Hind.* Vilva pazham, *Tam.* Bilvapandu, *Tel.*

Officinal part.—The half-ripe fruit. Roundish or subspherical, about the size of a large orange, smooth, with a hard woody rind; from 10 to 15 celled, the cells containing, besides the seeds, a large quantity of an exceedingly tenacious transparent mucous. It contains tannin and an essential oil.

Preparations.—

Mistura Belæ	A sherbet.
Extractum Belæ	ʒ ss to ʒ i.
Extractum Belæ liquidum	ʒ i to ʒ ii.

Properties.—Astringent. The ripe fruit is considered aromatic, cooling and laxative.

Uses.—It is a remedy of considerable value in cases of obstinate diarrhœa and dysentery when unattended by fever. In the obstinate diarrhœa and dysentery of children, it may be given in doses of from one-quarter to one-half the above. The fluid extract of the dried bael is regarded by many as superior to any other preparation of this fruit. In irregularity of the bowels, presenting alternations of diarrhœa and constipation, the mixture taken in the early morning is frequently efficacious in regulating the bowels.

Arachis hypogæa, Linn., Ground nut.

Vernacular.—Mungphalif, *Hind.* Verkadalai, *Tam.* Verusanagakaya, *Tel.*

Officinal part.—The oil of the seeds. It is obtained by expression, limpid clear, light yellow, faint odour, and a mild agreeable taste. Specific gravity 0·918. It can be used for all purposes in pharmacy in place of olive or almond oil.

Sesamum indicum, Linn., Gingelly seed.

Vernacular.—Til, *Hind.* Ellu, *Tam.* Nuvvulu, *Tel.*

Officinal part.—The oil. A clear limpid non-drying oil of a pale straw to dark amber colour, scarcely any odour, bland taste, not readily becoming rancid or thick. Gingelly-oil has been used from time immemorial for dietetic purposes throughout India, and the seeds enter largely into the composition of native confectionery.

Uses.—Gingelly-oil is used as an emollient. As a dressing, burns, &c., it is very useful and can be used as a substitute for olive oil in Lin Calcis.

Cocos nucifera, Linn., Cocoanut tree.

Vernacular.—Nairyal, *Hind.* Tenka, *Tam.* Narikadam, *Tel.* Tenga, *Mal.*

Officinal part.—The oil obtained by expression when freshly prepared, it is of a pale yellowish colour and almost inodorous, but after a few days it acquires a deeper hue and a peculiar rancid odour and taste. It solidifies at 70° Fahr.

Cocoanut-oil has been recommended as a substitute for codliver-oil in increasing the weight of the body, but occasionally its prolonged use induces disturbances of the digestive apparatus and diarrhœa; this objection may be removed by using the olive separated from the solid fats, as is done by the natives in the preparation of what they call muthel or hand oil. The oil is readily absorbed by the skin. In dry-fissured conditions of the skin it may prove useful. Cocoanut-oil is not suitable as a vehicle for liniments.

Acacia arabica, Willd., Babool tree.

Vernacular.—Bábul, *Hind.* Kuruveylam, *Tam.*

Officinal part.—The bark. The bark is hard and woody of a rusty brown colour, having a tendency to divide into several layers. The external surface is rugged and fissured longitudinally, the internal smooth and fibrous; taste astringent and mucilaginous. The gum is somewhat darker than that of *acacia vera,* but not much inferior in adhesive property.

Preparations.—

Decoction—Acaciæ arabicæ ..	℥ i to ℥ ii.
Mucilago acaciæ	℥ iii to ℥ vi daily.

The mucilage is used for the purpose of suspending heavy powders, in preparing tinctures, &c.

The decoction of the bark is a powerful astringent and contains a large quantity of tannin. It is used as a substitute for oak bark. It is used as an astringent gargle and lotion, and in cases where a vegetable astringent is indicated. Externally it is employed as an injection in leucorrhœa and for vaginal discharges, and for astringent enemata generally.

Hemidesmus indicus, Br., Hemidesmus or Indian Sarsaparilla.

Vernacular—Magruba, *Hind.* Nannari, *Tam.* Gadisugandi, *Tel.*

Officinal part.—The root. It occurs in pieces of various lengths of a yellowish brown colour cylindrical, tortuous, furrowed longitudinally. The cortex divided by annular cracks; odour peculiar and aromatic; taste feebly bitter and agreeable.

Preparations.—

Infusion .. .. .. Dose ℥ ip to ℥ iii.
Syrup .. .. .. ,, ʒ ss to ʒ ii.

The freshly-collected root is preferable to that bought in the bazaars, as that is often inodorous, tasteless, and almost worthless.

Hemidesmus is a valuable alterative tonic, diuretic and diaphoretic. It is used in cases of constitutional debility, chronic rheumatism, constitutional syphilis and indigestion. Its efficacy is much increased by being taken while the infusion is still warm.

Santalum album, Linn., Sandalwood tree.

Vernacular.—Sandal, *Hind.* Sandanak-kattai, *Tam.* Gandhapuchekka, *Tel.*

Officinal part.—The oil. Dose 10 to 30 mins. The oil is of a pale yellow colour, volatile, aromatic odour and slightly acrid taste.

Properties.—Diaphoretic, diuretic and sedative. The oil has been administered in remittent fevers and is said to have produced a sedative action on the heart. The chief use, however, is its action on the urethra in gonorrhœa in which disease it has been employed with very satisfactory results as compared with copaiba and cubebs. It has also been employed in chronic cystitis.

Brassica juncea, Linn., Indian mustard.

Vernacular.—Rai, *Hind.* Kadugu, *Tam.* Avalu, *Tel.*

Officinal part.—The powdered seeds. The seeds are oblong, light reddish brown, clean and bright. The surface does not appear rough unless magnified.

Preparations.—

Cataplasma sinapis.
Lin. sinapis co.
Oleum sinapis.

Properties.—Externally applied, rubefacient, and vesicant if kept long in contact with the skin. In moderate quantities, taken with food, it acts as a digestive: in doses varying from 1 to 3 teaspoonfuls in a tumblerfull of water, it acts as a speedy emetic.

Applied externally mustard poultices prove highly serviceable in the advanced stages or low forms of febrile and inflammatory fevers, in internal congestions, in spasmodic, neuralgic, rheumatic affections and other diseases where a counter-irritant is required. The liniment is mainly used as a stimulating embrocation in rheumatism.

Datura fastuosa, Linn., Datura alba. Linn.

Vernacular.—Dhatura, *Hind.* Umattai, *Tam.* Ummetta, *Tel.*

Officinal part.—Leaves and seeds.

The leaves are ovate, acuminate, repandly toothed unequal at the base, downy, emitting, especially when bruised, a peculiar heavy disagreeable odour.

Preparations.—

Tinctura daturæ	Dose 10 to 30 mms.
Extractum daturæ	,, ¼ to 1½ grains.
Euplastrum daturæ.	
Cataplasma daturæ.	

The seeds are about ⅜″ in length, reniform, flattened of a darkish brown colour, having a disagreeable bitter somewhat acrid taste. The activity of leaves and seed is due to daturine.

The physiological action of datura somewhat resembles belladonna. It is used as an anodyne antispasmodic and narcotic. In asthma, the dried leaves and stem cut small and smoked, like tobacco, in a pipe afford in many cases striking relief. When the leaves fail the dried seeds may be tried. From 10 to 20 grains of the dried plant is sufficient to commence with and should be discontinued if it produces giddiness, sickness or other unpleasant symptom. In chronic coughs when the cough comes on in violent paroxysms, and is hard and dry with scanty expectoration, smoking datura proves beneficial.

For rheumatic swellings of the joints, lumbago, painful tumours, syphilitic nodes, &c., datura locally applied is often serviceable in relieving pain. Local applications are also serviceable in relieving the pain attendant on painful or difficult menstruation and in some painful affections of the uterus. In neuralgia of the face the liniment is also useful.

A watery extract applied round the eyes dilate the pupils for several days. In tetanus the tincture has afforded some relief in averting spasms.

Ipomæa hederacea, Jacq. (Pharbitis nil)—Kaladanah.

Vernacular.—Kaládána, *Hind,* Kodikakkatanvirai, *Tam,* Kollivittulu, *Tel.*

Officinal part.—The seeds, black, angular, a quarter of an inch or more in length, weighing on an average ½ to 1 grain each. Upon soaking the seeds in water, the testa bursts. Taste acrid; odour earthy. Active principle Kaladana resin (Pharbitisin).

Preparations.—

Extractum kaladanæ		.. ..	Dose 5 to 10 grs.
Tinctura	do.	.. ..	,, ʒ ii to ʒ iii.
Pulvis	do. co.	.. ..	,, ʒ ss to ʒ i.
Resina (Pharbitisin)	do	.. ..	,, 5 to 8 grs.
Powdered seeds		.. ..	Dose 30 to 50 grs.

The seeds are a reliable purgative resembling in action that of jalap, for which it forms an excellent substitute, although somewhat slower in action.

Tinospora cordifolia, Miers. Gulancha.

Vernacular—Gulanchá, *Hind.* Shindilkodi, *Tam.* Tippatége, *Tel.* Lingomoné, *Burm.*

Officinal part.—The roots and stems. As met with in the bazaars, it consists of dried transverse segments of a cylindrical woody stem. These segments vary in diameter from ½ to 2″. They exhibit a shrunken appearance, especially those derived from the younger stems, and are covered with a smooth transparent bark. It is inodorous, but has a bitter taste. Its infusion is not blackened by a persalt of iron.

Preparations.—

Tinctura tinosporæ	.. ..	Dose ʒ i to ʒ ii.
Infusum tinosporæ	.. ..	.. ℥ i to ℥ iii.
Extractum tinosporæ	..	,, 10 to 30 grs.

Gulancha is a very useful tonic, and is best given in infusion. It has been used with benefit in mild forms of intermittent fevers, and in constitutional debility and loss of appetite after these and other fevers. It has also been found useful in some forms of dyspepsia in chronic rheumatism and some spleen disorders. An extract made by native doctors is said to have considerable repute in the above disorders, but it is frequently highly adulterated. It is known as Satgilo, *Hind.* Shindal-sharukarai, *Tam.* Teppasattu, *Tel.*

Andrographis paniculata, Nees, Creat or kariyat.

Vernacular.—Kiryat, *Hind.* Nilavembu, *Tam.* Neluvemu, *Tel.*

Officinal part.—The dried stalks and root. Annual, stem quadrangular, pointed, smooth, leaves opposite: upper surface dark green and shining, taste bitter. The root is fusiform, simple, woody, with numerous fine radicles.

Preparations.—

Infusum andrographis co. ..	Dose	℥ i to ℥ ii.
Tinctura andrographis co. ..	,,	ʒ i to ʒ iv.

Kariyat is a valuable bitter tonic and may be advantageously employed in cases of general debility, in convalescence after fevers and in advanced stages of dysentery and diarrhœa. It is frequently given to infants suffering from flatulence and diarrhœa caused by defective digestion.

Swertia chirata, Ham., Chiretta.

Vernacular.—Charayatah, *Hind.* Nilavembu, *Tam.* Nelavemu, *Tel.* Sekhagi, *Burm.*

Officinal part.—The entire plant. Stems about 3 feet long of the thickness of a goose quill, round, smooth, pale brown, branched, branches opposite; flowers small, numerous panicled. The whole plant intensely bitter. It contains a very bitter extractive and a resinous matter in which its virtues reside.

Preparations.—

Infusum chiratæ	Dose	℥ i to ℥ ii.
Tinctura chiratæ	,,	ʒ i to ʒ ii.

Chiretta is a good bitter tonic and renders the practitioner in India independent of imported articles of the same class. It may be given in all cases of debility, especially after fevers, in indigestion, loss of appetite, &c. It may also be given in mild cases of ague.

CHAPTER VIII.

FORMULÆ USED IN THE HOSPITALS OF MADRAS.

ANTISEPTICS, DISINFECTANTS AND DEODORIZERS.

Lotio Acidi Carbolici.

Take of—

Carbolic acid	1	part.
Warm water	39	parts.

Mix.

Lotio Acidi Carbolici Fortior.

Take of—

Carbolic acid	1	part.
Warm water	19	parts.

Mix.

Oleum Carbolatum.

Take of—

Carbolic acid	1	part.
Cocoanut-oil	19	parts.

Mix.

Lotio Zinci Chloridi.

Take of—

Chloride of zinc	40	grains.
Distilled water	1	pint.

Mix.

Lotio Sodæ Chlorinatæ.

Take of—

Solution of chlorinated soda	1	fl. ounce.
Distilled water	1	pint.

Mix.

This lotion is very liable to decomposition and should be made fresh whenever ordered.

Lotio Potassæ Permanganatis.

Take of—

Solution of permanganate of potash ...	4	fl. drachms.
Distilled water	1	pint.

Mix.

If Condy's disinfecting fluid is used, the strength should be two fluid drachms to one pint.

Lotio Hydrargyri Perchloridi, 1 *in* 2,000

Take of—

Perchloride of mercury	7	grains.
Water	32	ounces.

Dissolve and add fuchsine solution sufficient to impart pale pink colour.

Lotio Iodi.

Take of—

Tincture of iodine	1	drachm.
Water	10	ounces.

Mix.

Balneum Sinapis.

Take of—

Mustard in powder	2	ounces.
Warm water	4	gallons.

Mix.

Balneum Vaporis.

Place the patient naked on a cane-bottomed chair and envelop him in a blanket. Then set under the chair a small copper bath full of hot water and supported on legs, and place below it a lighted spirit lamp with strong flame. Lee's lamp may be used.

This bath may be medicated by sublimiug calomel, iodine, sulphur, &c., on a heated metallic plate.

BOLUSES.

Bolus Ipecacuanhæ.

Take of—

Powder of ipecacuanha	20	grains.
Simple syrup, a sufficiency.		

Mix.

To be generally preceded by an opiate draught.

BOUGIA.

These are usually made about the size of a number nine catheter and in length two inches.

Gallic acid, 1 grain; tannic acid, 1 grain; nitrate of silver, $\frac{1}{2}$ or $\frac{1}{4}$ grain; extract of belladonna, $\frac{1}{2}$ grain; sulphate of copper, 1 grain; perchloride of iron, 1 grain; opium, 1 or 2 grains; dried sulphate of zinc, 1 grain; iodoform, 3 grains.

Take any of the above drugs and make them into a bougie with oil of theobroma, five parts; mutton suet, five parts; spermaceti, sixty parts.

Enema Commune.

Take of—

Table salt	1 ounce.
Congee water	20 fl. ounces.

Mix.

Enema Olei Ricini.

Take of—

Castor oil	2 fl. ounces.
Congee-water	12 fl. ounces.

Mix.

Enema Terebinthinæ.

Take of—

Oil of turpentine	1 fl. ounce.
Castor-oil	$\frac{1}{2}$ fl. ounce.
Congee water	$18\frac{1}{2}$ fl. ounces.

Mix.

Enema Nutritivum.

Take of—

Milk	$\frac{1}{2}$ ounce.
Egg	1
Brandy or arrack	$\frac{1}{2}$ ounce.
Tincture of opium	20 minims.
Essence of beef or strong beef-tea	2 to 4 ounces.

Mix.

FOMENTATIONS.

Fotus Camphoræ et Opii

Flannel or spongio-piline wrung out of hot water and sprinkled with the following :—

Tincture of opium Spirits of camphor	of each 2 fl. drachms.

Mix.

Fotus Papaveris.

Take of—

Poppy capsules sliced and pounded in a mortar	Four.
Water	30 fl. ounces.

Mix.

Boil for 15 minutes and strain.

Fotus Terebinthinæ.

Flannel or spongio-piline wrung out of hot water (150 F.) and sprinkled with half a fluid ounce of turpentine changed in twenty minutes.

INJECTIONS (HYPODERMIC).

Injectio Morphinæ Hypodermica.

Prepared as in the British Pharmacopœia.

Strength, 1 grain of acetate of morphine in 10 minims of the solution.

Dose, 1 to 6 minims.

Injectio Atropinæ Sulphatis Hypodermica.

Take of—

Solution of sulphate of atropine. B.P.	1 fl. drachm.
Distilled water	2 fl. drachms.

Strength, 6 minims contain $\frac{1}{60}$ grain of sulphate of atropine.

Dose, 3 to 6 minims.

Injectio Morphinæ et Atropinæ Hypodermica 'Squires.'

Take of—

Sulphate of atropine	1 grain.
Acetate of morphine	10 grains.
Water	1 drachm.

Each minim contains $\frac{1}{60}$th of a grain of sulphate of atropine and $\frac{1}{6}$th of a grain of acetate of morphine.

Dose, 2 or 3 minims.

LOTIONS.

Lotio Evaporans.

Take of—

Hydrochlorate of ammonia	180 grains.
Vinegar	2 fl. ounces.
Arrack	2 fl. ounces.
Water	6 fl. ounces.

Mix.

Lotio Plumbi cum Opio.

Take of—

Solution of the subacetate of lead ...	30 minims.
Tincture of opium	1¼ fl. drachms.
Water	to 6 fl. ounces.

Mix.

Lotio Opii.

Take of—

Opium	36 grains.
Boiling water	6 fl. ounces.

Macerate and apply warm on lint under oiled silk.

Lotio Zinci Rubra.

Take of—

Sulphate of zinc	20 grains.
Compound tincture of lavender ...	1 fl. drachms.
Water	to 6 fl. ounces.

Mix.

Lotio Sedativa.

(EAU SEDATIVE.)

Take of—

Spirits of camphor	1 fl. drachm.
Strong solution of ammonia	7 fl. drachms.
Distilled water	12½ fl. ounces.

Mix.

MIXTURES.

Mistura Potassii Iodidi No. 1.

Take of—

Iodide of potassium	120 grains.
Aromatic spirits of ammonia	120 minims.
Infusion of gentian	24 fl. ounces.

Mix.

Dose, 1 to 1½ ounces.

Mistura potassii iodidi No. 2 contains double the quantity of iodide of potassium and double the quantity of aromatic spirits of ammonia to the same amount of infusion.

Mistura Hydrargyri Perchloridi.

Take of—

Solution of perchloride of mercury, B.P.	12 fl. drachms.
Distilled water	9 fl. ounces.
Compound tincture of cinchona	1½ fl. ounces.
Tincture of rhubarb	6 fl. drachms.

First add the solution of perchloride to the water and then add the tinctures.

Strength, each fluid ounce contains $\frac{1}{16}$ grains of perchloride of mercury.

Dose, 1 fluid ounce.

Mistura Cinchonini.

Take of—

Sulphate of cinchonine	16 grains.
Dilute sulphuric acid	20 minims.
Water	4 fl. ounces.

Mix.

Dose, 1 to 2 ounces.

Mistura Quininæ.

Take of—

Sulphate of quinine	48 grains.
Dilute sulphuric acid	40 minims.
Tincture of orange peel	2 fl. drachms.
Syrup	6 fl. drachms.
Water	11 fl. ounces.

Dissolve the quinine in the acid, first mixed in half an ounce of water, then add the other ingredients and the water.

Dose, 1 to 3 ounces.

Mistura Cinchonæ.

(FEVER MIXTURE.)

Take of—

Cinchona bark (in coarse powder)	1¼ ounces.
Dilute hydrochloric acid	2 drachms.
Water, a sufficiency.	

Boil the cinchona bark for ten minutes in ten ounces of water and filter.

Mix the hydrochloric acid with ten ounces of water and pour it slowly over the dregs in the strainer, finally pass enough water through the filter to make the product measure one pint.

Dose, 1 to 3 ounces.

MIXTURES (ASTRINGENT).

Mistura Acidi Sulphurici cum Opio.

Take of—

Dilute sulphuric acid	2 fl. drachms.
Tincture of opium	2 fl. drachms.
Cinnamon water	11½ fl. ounces.

Mix.

Dose, 1 fluid ounce.

Mistura Cretæ cum Opio.

Take of—

Chalk mixture	5½ fl. ounces.
Tincture of catechu	2 fl. drachms,

Mistura Cretæ cum Opio—cont.

Tincture of opium	½ fl. drachm.
Chloroform	½ fl. drachm.
Ipecacuanha wine	1 fl. drachm.

Mix.

Dose, 1 fluid ounce.

Mistura Cretæ cum Catechu.

Take of—

Chalk mixture	5½ fl. ounces.
Tincture of catechu	2 fl. drachms.
Chloroform	½ fl. drachm.
Ipecacuanha wine	1 fl. drachm.

Mix.

Dose, 1 fluid ounce.

MIXTURES (CARMINATIVE).

Mistura Carminativa.

Take of—

Aromatic spirits of ammonia	3 fl. drachms.
Bicarbonate of soda	90 grains.
Compound tincture of cardamoms	6 fl. drachms.
Spirits of chloroform	3 fl. drachms.
Peppermint water	10½ fl. ounces.

Mix.

Dose, 1 fluid ounce.

MIXTURES (COUGH).

Mistura Cascarillæ.

Take of—

Tincture of squills	3 fl. drachms.
Compound tincture of camphor	1½ fl. ounces.
Infusion of cascarilla to make	12 fl. ounces.

Mix.

Dose, 1 fluid ounce.

Mistura Ipecacuanhæ Opiata.

Take of—

Bicarbonate of soda	60 grains.
Ipecacuanha wine	2 fl. drachms.

Mistura Ipecacuanhæ Opiata—cont.

Spirits of chloroform	3	fl. drachms.
Compound tincture of camphor	4	fl. drachms.
Distilled water	11	fl. ounces.

Dose, 1 fluid ounce.

Linctus Opiatus.

Take of—

Tincture of opium	2	fl. drachms.
Dilute sulphuric acid	2½	fl. drachms.
Treacle	8	fl. ounces.
Water	3	fl. ounces.

Mix the treacle with the water and then add the acid and tincture.

Dose, one to two teaspoonfuls.

Mistura Senegæ.

Take of—

Carbonate of ammonia	60	grains.
Tincture of senega	6	fl. drachms.
Infusion of senega	6	fl. ounces.
Distilled water	5¼	fl. ounces.

Dose, 1 fluid ounce.

Mistura Diaphoretica.

Take of—

Solution of acetate of ammonia	1½	fl. ounces
Spirit of nitrous ether	1⅓	fl. drachms.
Tincture of hyoscyamus	2	fl. drachms.
Nitrate of potash	30	grains.
Infusion of serpentaria to make	8	fl. ounces.

Mix.

Dose, 1 to 2 ounces.

Mistura Diuretica.

Take of—

Spirit of juniper	3	fl. drachms.
Acetate of potash	220	grains.
Nitrate of potash	120	grains.
Spirit of nitrous ether	6	fl. drachms.
Decoction of broom to make	12	fl. ounces.

Mix.

Dose, 1 ounce.

Mistura Copaibæ.

Take of—

Copaiba	1	fl. ounce.
Solution of potash	½	fl. ounce.
Spirit of nitrous ether	½	fl. ounce.
Acacia powder	80	grains.
Tincture of hyoscyamus	½	fl. ounce.
Cinnamon water	5½	fl. ounces.

Mix.

Dose, ½ a fluid ounce.

Mistura Ferri Diuretica.

Take of—

Tincture of perchloride of iron	1	fl. drachm.
Dilute nitro-muriatic acid	1	fl. drachm.
Spirit of chloroform	3	fl. drachms.
Spirit of juniper	2	fl. drachms.
Infusion of quassia	2	fl. drachms.
Decoction of broom to make	12	fl. ounces.

Dose, 1 to 2 fluid ounces.

Mistura Digitalis et Scillæ.

Take of—

Tincture of digitalis	2	drachms.
Tincture of squill	2	drachms.
Decoction of broom	12	ounces.

Mix.

Dose, 1 ounce.

Mistura Sennæ Composita.

(BLACK DRAUGHT).

Take of—

Sulphate of magnesia	5	ounces.
Strong tincture of ginger	1	fl. drachm.
Infusion of senna	1	pint.

Mix.

Dose, 2 to 4 ounces.

Mistura Potassæ Nitratis.

Take of—

Nitrate of potash	180	grains.
Peppermint water	10½	fl. ounces.
Spirit of nitrous ether	3	fl. drachms.
Syrup of lemons	1	fl. ounce.

Mix.

Dose, 1 fluid ounce.

Mistura Potassæ Chloratis.

Take of—

Chlorate of potash in powder	120	grains.
Decoction of cinchona	12	fl. ounces.

Dissolve.

Dose, 1 fluid ounce.

Mistura Magnesiæ et Magnesiæ Sulphatis.

Take of—

Carbonate of magnesia	126	grains.
Sulphate of magnesia	2	ounces.
Peppermint water	12	fl. ounces.

Dissolve the sulphate of magnesia in the peppermint water and finally rub down with it the carbonate in a mortar.

Dose, 1 fluid ounce.

Mistura Rhei Composita.

Take of—

Rhubarb root, powdered	50	grains.
Calumba root, powdered	100	grains.
Bicarbonate of soda	100	grains.
Peppermint water	12	fl. ounces.

Rub the rhubarb, soda, and calumba well together and then gradually add the peppermint water.

Dose, 1 fluid ounce.

Mistura Bismuthi Sedativa.

Take of—

Subnitrate of bismuth	84	grains.
Bicarbonate of soda	84	grains.
Solution of hydrochlorate of morphine	2	fl. drachms.
Mucilage of gum acacia	1½	fl. ounces.
Distilled water to make	12	fl. ounces.

Rub the bismuth and soda well together, then mix with the mucilage, add the water gradually, and lastly, the morphine.

Dose, 1 fluid ounce.

Mistura Effervescens.

Take of—

Bicarbonate of soda	16	grains.
Water	1	fl. ounce.

Mix and dissolve in one glass.

Mistura Effervescens—cont.

Take of—

Tartaric acid	15	grains.
Water	1	fl. ounce.

Mix and dissolve in another glass.

Dose. The fluids to be mixed and drunk during effervescence.

Mistura Ammoniæ Effervescens.

Take of—

Carbonate of ammonia	15	grains.
Water	1	fl. ounce.

Mix and dissolve in one glass.

Take of—

Citric acid	17	grains.
Water	1	fl. ounce.

Mix and dissolve in another glass.

Dose. The fluids to be mixed and drunk during effervescence.

Mistura Bromidia.

Take of—

Bromide of potassium	240	grains.
Hydrate of chloral	180	grains.
Tincture of Indian hemp	2	fl. drachms.
Tincture of hyoscyamus	6	fl. drachms.
Camphor water	to 12	fl. ounces.

Mix.

Dose, 1 ounce at bed time.

Mistura Asthmatica.

Take of—

Iodide of potassium	60	grains.
Bromide of potassium	240	grains.
Carbonate of ammonia	60	grains.
Tincture of belladonna	1	fl. drachm.
Tincture of lobelia	3	fl. drachms.
Ether	3	fl. drachms.
Spirits of chloroform	2	fl. drachms.
Camphor water	to 12	fl. ounces.

Mix.

Dose, one ounce.

Mistura Stimulans.

Take of—

Aromatic spirits of ammonia	6 fl. drachms.
Spirit of ether	1½ fl. ounces.
Chloroform water	to 12 fl. ounces.

Mix.

Dose, 1 ounce.

Mistura Spiritus Vini Indici.

Take of—

Arrack	4 fl. ounces.
Yolk of eggs	2
Cinnamon water	6 fl. ounces.
White sugar	120 grains.

Dose, 1½ to 2 ounces.

Mistura Terebinthinæ Alcoholica.

(*Turpentine Punch. "Graves."*)

Take of—

Spirits of turpentine	1 fl. ounce.
Brandy or arrack	2 fl. ounces.
Sugar, a sufficiency.	
Boiling water	8 fl. ounces

Mix.

Half for a dose, to be repeated if necessary every third hour.

Mistura Ferri Perchloridi.

Take of—

Tincture of perchloride of iron	2 fl. drachms.
Infuison of quassia	to 12 fl. ounces.

Mix.

Dose, 1 fluid ounce.

Mistura Strychniæ et Ferri.

Take of—

Solution of strychnia	40 minims.
Dilute nitro-muriatic acid	80 minims.
Tincture of perchloride of iron	80 minims.
Syrup of orange peel	4 fl. drachms.
Water	to 8 fl. ounces.

Dose, ½ to 1 ounce, three times a day.

Mistura Sulphatis Triplicis.

Take of—

Sulphate of quinine	24 grains.
Sulphate of iron	24 grains.
Sulphate of magnesia	2 ounces.
Dilute sulphuric acid	120 minims.
Peppermint water	to 12 fl. ounces.

Mix.

Dose, 1 ounce.

Mistura Acidi Nitro Hydrochlorici.

Take of—

Diluted nitro-hydrochloric acid	2 fl. drachms.
Infusion of chiretta	to 12 fl. ounces.

Mix.

Dose, 1 fl. ounce.

Mistura Hepatica.

Take of—

Sulphate of quinine	36 grains.
Chloride of ammonium	240 grains.
Dilute hydrochloric acid	2 fl. drachms.
Extract of liquorice	10 grains.
Infusion of chiretta	to 12 fl. ounces.

Mix.

Dose, 1 ounce.

Mistura Ammonii Chloridi.

Take of—

Chloride of ammonium	240 grains.
Extract of liquorice	10 grains.
Infusion of chiretta	12 fl. ounces.

Mix.

Dose, 1 ounce.

Twining's Mixture for Enlarged Spleen.

Take of—

Powdered jalap	120 grains.
Powdered rhubarb	120 grains.
Powdered calumba	120 grains.
Acid tartrate of potash	60 grains.
Powdered ginger	60 grains.
Sulphate of iron	10 grains.
Tincture of senna	4 fl. drachms.
Peppermint water	to 40 fl. ounces,

Mix.

Dose, 1 ounce.

Mistura Olei Dipterocarpi.

Take of—

Gurjun oil Lime water	equal parts.

Mix.

Dose, 1 dessert-spoonful, twice a day.

Mistura Baelæ.

(*Bael Mixture.*)

Take of the soft tenacious pulp of the interior of the fruit two fluid ounces; water, four ounces; mix thoroughly and add sugar two ounces or sufficient to render it palatable. Pass the mixture through coarse muslin. A little lime juice may be added to improve the flavour.

The above is a dose, or it may be given in small and repeated doses.

MUCILAGES.

Mucilago Acaciæ.

Take of—

Gum acacia in small pieces	4 ounces.
Distilled water	6 fl. ounces.

Put the gum and water into a covered earthen jar and stir them frequently until the gum is dissolved. If necessary strain the solution through muslin.

Mucilago Amyli.

Take of—

Starch	120 grains.
Distilled water	10 fl. ounces.

Triturate the starch with the water gradually added, then boil for a few minutes constantly stirring.

PILLS.

Pilula Aloinæ et Myrrhæ, No. 1.

(Sir Andrew Clarkes Dinner Pill.)

Take of—

Aloin.
Extract of nux vomica.
Sulphate of iron.
Myrrh.
Soap, of each ½ a grain.

Mix accurately and make into a pill. To be taken half an hour before the last meal.

Pilula Aloinæ et Myrrhæ, No. 2.

The same as No. 1, with
Ipecacuanha, ½ a grain added.
To be given if the fæces are hard and dry.

Pilula Aloinæ et Myrrhæ, No. 3.

The same as Numbers 1 and 2, with
Extract of belladonna, ½ a grain added.
To be given when either Numbers 1 or 2 cause griping.

Pilula Colocynthidis et Calomelanos.

(Colocynth and Calomel Pills.)

Take of—

Compound pill of colocynth	48 grains.
Calomel	12 grains.

Mix and form 12 pills.
Dose, 1, 2, or 3 pills.

Pilula Hydrargyri et Rhei.

(Rhubarb and Blue Pills.)

Take of—

Mercurial pill	30 grains.
Compound rhubarb pill	30 grains.

Mix accurately and divide into 12 pills.
Dose, 1 or 2 pills.

Pilula Calomelanos et Scillæ.

(Calomel and Squill Pills.)

Take of—

Calomel	12 grains.
Squill root, powdered	12 grains.
Digitalis leaf, powdered	12 grains.
Extract of hyoscyamus	20 grains.

Mix and make into 12 pills.
Dose, 1 pill.

Pilula Camphoræ et Hyoscyami.

(Camphor and Hyoscyamus Pills.)

Take of—

Camphor	24 grains.
Extract of hyoscyamus	36 grains.

Mix and divide into 12 pills.
Dose, 1 or 2 pills.

Pilula Quininæ Sulphatis.

Take of—

Sulphate of quinine	60 grains.
Lime juice, a sufficiency.	

Mix carefully and make into 12 pills.
Dose, 1 to 4 pills.

Pilula Quineti.

(Darjeeling Alkaloid Pill.)

Take of—

Quinetum	60 grains.
Lime juice, a sufficiency.	

Mix carefully and make into 12 pills.
Dose, 1 to 4 pills.

Pilula Ipecacuanhæ cum Opio.

(Ipecacuanha and Opium Pills.)

Take of—

Ipecacuanha powder	48 grains.
Extract of opium	6 grains.

Mix and divide into 24 pills.
Dose, 1, 2, or more pills.

Pilula Ferri Sulphatis, "Blaud."

Take of—

Pure sulphate of iron.
Pure carbonate of potash of each ¼ of an ounce.
Powdered gum Tragacanth, a sufficient quantity.
Make into 46 pills.

Dose, 3 pills, increased to 4 or 5 if well borne, thrice daily.
Each pill contains about 2 grains of sulphate of iron.

Powders.

Pulvis Emeticus.

Take of—

Powdered ipecacuanha root	1 ounce.
Tartarated antimony	12 grains.

Mix.
Dose, 5 to 20 grains.
To be prepared in the same way.

Pulvis Santonini Co.

(Worm Powders.)

Take of—

Santonine	20 grains.
Powdered ginger	20 grains.
Powdered seeds of *Butea frondosa* ...	400 grains.

Dose, 15 to 25 grains morning and evening, to be followed by a purgative.

PIGMENTS.

Belladonna Pigment.

Take of—

Extract of belladonna	120 grains.
Glycerine, a sufficiency.	

Rub the extract of belladonna in a mortar with a little glycerine, using sufficient to make it into a thin paste.

FOR CHILDREN.

The following formulæ are calculated for children one year old, unless otherwise stated.

Mistura Acidi Gallici cum Opio.

Take of—

Gallic acid	8 grains.
Tincture of cinnamon	1 fl. drachm.
Liquid extract of opium	8 fl. minims.
Mucilage of gum	2 fl. drachms.
Cinnamon water	5 fl. drachms.
Water	to 2 fl. ounces.

Mix.

Dose, 1 to 2 drachms, every six hours.

Two drachms contain—

Gallic acid	2 grains.
Liquid extract of opium	2 minims.

Mistura Alterativa.

Take of—

Syrup of the iodide of iron	6 minims.
Infusion of quassia	to 4 fl. ounces.

Dose, 1 to 2 drachms.

Mistura Hæmatoxyli.

Take of—

Tincture of catechu	2 fl. ounces.
Extract of logwood	1 ounce.
Carraway water	to 12 fl. ounces.

Mix.

Dose, ½ to 1 drachm.

Mistura Astringens.

Take of—

Aromatic chalk powder	30 grains.
Tincture of catechu	1 drachm.
Mucilage	2 drachms.
Peppermint water	to 1 ounce.

Mix.

Dose, 1 fluid drachm.

Mistura Acidi Astringens.

Take of—

Dilute sulphuric acid	18 drops.
Tincture of catechu	36 drops.
Syrup of ginger	2 drachms.
Water	9 drachms.

Mix.

Dose, 2 drachms, every fourth hour.

Mistura Rubri.

Take of—

Rhubarb	10 grains.
Carbonate of magnesia	30 grains.
Aromatic spirits of ammonia	30 minims.
Aniseed oil	2 drops.
Water	2 fl. ounces.

Mix.

Dose, 1 drachm, repeated every fourth hour till it operates.

Mistura Olei Ricini.

Take of—

Powdered acacia	3 drachms.
Powdered loaf sugar	3 drachms.
Oil of peppermint	2 drops.
Castor oil	1 fl. ounce.

Rub the acacia, sugar, and oil of peppermint together into a powder; add about six drachms of water; then add the castor oil by degrees, with a little more gum or a little more water, as may be necessary to make a perfect emulsion. Then add water slowly to bring the quantity to four ounces.

Dose, ½ to 1 drachm every fourth or sixth hour, in inflammatory diarrhœa. 4 drachms as an aperient.

Mistura Olei Ricini cum Opio.

Take of—

Castor oil	1 fl. drachm.
Powdered gum	32 grains.
Powdered sugar	32 grains.
Tincture of opium	4 minims.
Aniseed water	to 1 fl. ounce.

Mix.

Dose, 1 to 2 drachms.

One drachm contains—

Castor oil	7½ minims.
Gum	4 grains.
Sugar	4 grains.
Tincture of opium	½ minim.

Mistura Stimulans et Tonica.

(*Dr. Tanner.*)

Take of—

Carbonate of ammonia	32 grains.
Spirits of chloroform	1 fl. drachm.
Compound tincture of cinchona	4 fl. drachms.
Peppermint water	to 8 fl. ounces.

Mix.

Dose, 2 to 4 drachms, every six hours.

One drachm contains—

Carbonate of ammonia	½ grains.
Spirits of chloroform	1¼ minims.
Compound tincture of cinchona	4 minims.

Mistura Quininæ Tonica.

Take of—

Sulphate of quinine	4 grains.
Lime juice	20 drops.
(or four drops of diluted sulphuric acid).	
Infusion of orange peel	2 fl. ounces.

Mix.

Dose, 1 to 2 drachms, three times a day, shortly before food.

Pulvis Santonini cum Hydrargyri.

Take of—

Calomel	10 grains.
Santonine	20 grains.
Sugar, powdered	60 grains.

Dose, 5 to 6 grains, twice a day.

Pulvis Ipecacuanhæ et Potassæ Nitratis.

Take of—

Ipecacuanha in powder	10 grains.
Nitrate of potash	60 grains.
Dover's powder	5 grains.

Mix.

Dose, 3 to 4 grains, every fourth hour.

Pulvis Quininæ et Potassæ Chloratis.

Take of—

Chlorate of potash	40 grains.
Powdered ipecacuanha	10 grains.
Sulphate of quinine	20 grains.
White sugar, powdered	80 grains.

Mix.

Dose, 5 to 8 grains, every fourth hour.

Pulvis Hydrargyri cum Ipecacuanha.

Take of—

Mercury and chalk	100 grains.
Ipecacuanha, powdered	25 grains.
Dover's powder	50 grains.
Bicarbonate of soda	200 grains.

Mix.

Dose, 3 to 5 grains, every fourth hour.

Seidlitz Powder for Children.

Take of—

Bicarbonate of soda	10 grains.
Tartrated soda	30 grains.

Dissolve in one ounce of water, adding a little syrup and essence of lemon. Then in another glass dissolve eight grains of tartaric acid in one table-spoonful of water. The contents of the glasses should be poured together, and the whole drank while effervescing. An agreeable mild aperient in the warm weather for strong children, but it is not one which should be frequently used.

Alterative Astringent Powder.

Take of—

Aromatic powder of chalk	2 drachms.
Rhubarb in powder	½ drachm.
Bicarbonate of soda	1 drachm.

Mix.

Dose, 2 to 5 grains.

Fever Powder.

Take of—

Antimonial powder	1 drachm.
Nitrate of potash	1 drachm.

Rhubarb in powder	1 drachm.
Sulphate of cinchonine	½ drachm.

Mix.

Dose, 1 to 2 grains.

Pulvis Ipecac et Sodii Bicarb.

Take of—

Ipecacuan powder	½ drachm.
Bicarbonate of soda	1 drachm.

Mix.

Dose, 1 grain.

Pulvis Ipecac cum Soda et Opio.

Take of—

Ipecacuan powder	½ drachm.
Dover's powder	½ drachm.
Bicarbonate of soda	1 drachm.

Mix.

Dose, ½ to 1 grain.

Pulvis Ipecac Comp. cum Acid Gallic.

Take of—

Dover's powder	1 drachm.
Gallic acid	1 drachm.

Mix.

Dose, ½ to 1 grain.

Pulvis Ipecac Comp. cum Ipecac.

Take of—

Dover's powder	5 drachms.
Ipecacuan powder	½ drachm.

Mix.

Dose, ½ to 1 grain.

Pulvis Alumen et Sodii cum Pottassa Chlorata.

Take of—

Alum in powder	1 drachm.
Bicarbonate of soda	1 drachm.
Chlorate of potash	1 drachm.

Mix.

Dose, 10 grains in one ounce of honey as an application to mouth.

Compound Liquorice Powder.

(Modified.)

Take of—

Sublimed sulphur	2 ounces.
Senna leaves in powder	2 ounces.
Liquorice root in powder	2 ounces.
Aniseed fruit in powder	2 ounces.
Powdered ginger	2 drachms.
White sugar	5 ounces.

Mix.

Dose, 1 teaspoonful.

EAR FORMULÆ.

Guttæ Acidi Carbolici.

Take of—

Carbolic acid (crystal)	60 grains.
Rectified spirit Distilled water } of each	15 fl. drachms.

Mix.

Guttæ Plumbi Subacetatis.

Take of—

Solution of subacetate of lead	20 minims.
Distilled water	2 fl. ounces.

Mix.

Guttæ Zinci et Carbolici.

Take of—

Sulphate of zinc	8 grains.
Carbolic acid (crystal)	4 grains.
Glycerine, pure	1 drachm.
Distilled water	to 2 fl. ounces.

Mix.

Guttæ Sodii Bicarbonatis.

Take of—

Bicarbonate of soda	10 grains.
Distilled water	1 fl. ounce.

Mix.

Ferrier's Snuff.

Take of—

Hydrochlorate of morphine	2 grains.
Subnitrate of bismuth	6 drachms.
Acacia powder	2 drachms.

Mix.

EYE FORMULÆ.

Alum Eye-drops.

Take of—

Alum	1 grain.
Distilled water	1 fl. ounce.

Mix.

(And various strengths from 1 to 10 grains
to one ounce of distilled water.)

Sulphate of Copper Eye-drops.

Take of—

Sulphate of copper	1 grain.
Distilled water	1 fl. ounce.

Dissolve.

(And various strengths from 1 grain
to one ounce, up to a saturated solution.)

Boric acid Eye-drops.

Take of—

Boric acid	3 grains.
Distilled water	1 fl. ounce.

Mix.

(And various strengths from 3 grains
to one ounce, up to a saturated solution.)

Sulphate of Zinc Eye-drops.

Take of—

Sulphate of zinc	1 grain.
Distilled water	1 fl. ounce.

Dissolve.

(And various strengths from 1 to 4 grains
to one ounce of distilled water.)

Alum and Zinc Eye-drops.

Take of—

Alum	6 grains.
Sulphate of zinc	12 grains.
Glycerine	1 fl. ounce.
Distilled water	6 fl. ounces.

Mix.

Sub-acetate of Lead Eye-drops.

Take of—

Solution of sub-acetate of lead	2 fl. ounces.
Rectified spirit	2 fl. ounces.
Distilled water	19½ fl. ounces.

Mix and filter through paper.

Chloride of Zinc Eye-drops.

Take of—

Chloride of zinc	1 grain.
Distilled water	1 fl. ounce.

Dissolve.

(And various strengths from 1 to 30 grains to one ounce of distilled water.)

Corrosive Sublimate Eye-drops.

Take of—

Perchloride of mercury	1 grain.
Hydrochlorate of ammonia	8 grains.
Distilled water	8 fl. ounces.

Dissolve.

Nitrate of Silver Eye-drops.

Take of—

Nitrate of silver	1 grain.
Distilled water	1 fl. ounce.

Dissolve.

(And various strengths from 1 grain to one ounce up to a solution of 20 grains to one drachm.)

Tannin Eye-drops.

Take of—

Tannic acid	30 to 60 grains.
Glycerine	2 fl. drachms.
Water	5 fl. drachms.

Dissolve and filter.

Atropine Eye-drops.

Take of—

Sulphate of atropine	1 grain.
Saturated solution of boric acid ...	1 fl. ounce.

Mix.

(And various strengths from 1 to 8 grains to one ounce.)

Eserine Eye-drops.

Take of—

Eserine	2 grains.
Saturated solution of boric acid ..	1 fl. ounce.

Dissolve.

Cocaine Eye-drops.

Take of—

Hydrochlorate of cocaine	10 to 20 grains.
Saturated solution of boric acid ...	1 fl. ounce.

Mix.

PLASMATA GLYCERINATES.

Belladonna Plasma.

Take of—

Extract of belladonna	120 grains.
Glycerine	1 fl. drachm.
Water	1 fl. drachm.

Mix.

This plasma may be of various strengths. It is expedient not to increase the quantity of glycerine, otherwise absorption by the skin is interfered with.

Sulphate of Copper Plasma.

Take of—

Sulphate of copper	24 grains.
Starch	90 grains.
Glycerine	10⅓ drachms.

Dissolve the sulphate of copper in the glycerine, add the starch and boil on a slow fire, stirring until the plasma becomes of the proper consistence.

Plasma of Ammoniated Mercury.

Take of—

Ammoniated mercury	30 grains.
Starch	90 grains.
Glycerine	10½ drachms.

Mix the mercury with the starch and then add the glycerine and proceed as with sulphate of copper plasma.

Plasma of Nitrate of Mercury.

Take of—

Nitrate of mercury	40 grains.
Starch	90 grains.
Glycerine	10½ drachms.

Prepare as in plasma of sulphate of copper.

Plasma of Red Oxide of Mercury.

Take of—

Red oxide of mercury	45 grains.
Starch	90 grains.
Glycerine	10½ drachms.

Prepare as in plasma of sulphate of copper.

PIGMENTA. PIGMENTS.

Iodine Pigment.

Take of—

Iodine	60 grains.
Rectified spirit	1 fl. ounce.
Mastiche	30 grains.

Dissolve.

(In Europeans and persons of delicate skin this pigment should be used of less strength, the iodine being reduced from 60 to 30 grains.)

UNGUENTA. OINTMENTS.

Ointment of Nitrate of Mercury.

One part of the ointment (B.P.) to seven of vaseline. A milder ointment has one part to nine of vaseline.

Ointment of Red Oxide of Mercury.

Take of—

Red oxide of mercury	40 grains.
Vaseline	4 ounces.

Mix.

Ointment of Yellow Oxide of Mercury.

Take of—

Yellow oxide of mercury	40 grains.
Vaseline	4 ounces.

Mix carefully and thoroughly.

GYNÆCOLOGICAL FORMULÆ.

Iodized Phenol.

Take of—

Iodine	1 drachm.
Water	½ fl. drachm.
Carbolic acid	½ fl. ounce.

Mix.

Glycerine and Iodized Phenol.

(Half Iodized Phenol.)

Take of—

Iodized phenol	½ fl. ounce.
Glycerine	½ fl. ounce.

Mix.

Glycerine et Cupri Sulph.

A saturated solution of sulphate of copper in glycerine.

Glycerin Acid Tannic cum Morphina.

Take of—

Glycerine of tannic acid	1 fl. ounce.
Hydrochlorate of morphine	8 grains.

Mix in a gentle heat in a water bath.

Glycerinum Ferri.

Strong neutral solution Perchloride of iron	½ fl. ounce.
Glycerine	½ fl. ounce.

Mix.

Solution of Chromic Acid.

Take of—

Chromic acid	2 drachms.
Water	2 drachms.

Mix.

Solution Argt. Nitras 20.

Take of—

Nitrate of silver	20 grains.
Distilled water	1 fl. ounce.

Mix.

Solution Argt. Nitras 40.

Take of—

Nitrate of silver	40 grains.
Distilled water	1 fl. ounce.

Mix.

Solution Argt. Nitras 60.

Take of—

Nitrate of silver	60 grains.
Distilled water	1 fl. ounce.

Mix.

Lugol's Solution.

Take of—

Iodine	2 drachms.
Iodide of potash	2 drachms.
Water	4 fl. drachms.

Mix.

APPENDIX A.

Extract from the Annual Report of the Principal, Medical College, Madras, for the year 1896–97.

College Department—*Revision of University Bye-laws.*—The University bye-laws relating to Medical students have been recently revised and will affect those students who enter for University degrees from and after next session. The following are the salient points of those revised rules as they affect L.M. and S. students. Hospital attendance begins in the second year of training, and two additional courses have been added to the existing curriculum, viz., a course of Practical Pathology and Bacteriology and a course of Mental Diseases, with attendance for clinical instruction in a Lunatic Asylum. A single course of Anatomy, Surgery and Medicine are now prescribed instead of the two courses heretofore given on these subjects, and an additional examination at the end of the third year has been interposed between the existing 1st and 2nd L.M. and S. examinations.

The revision of the bye-laws bearing on the M.B. and C.M. degree are much more extensive: they tend to develop the scientific side of the training for this degree, especially in the subjects of Pathology, Physiology and Bacteriology and to make the final year of study as far as practicable a purely practical one. A course of General Biology to be taken in the first year has been substituted for the existing courses of Botany and Comparative Anatomy. Additional courses have been added to the existing curriculum on the subjects of Physiological Chemistry, Practical Physiology, Practical Pathology and Bacteriology and Mental Diseases and the two courses of Anatomy, Physiology, Medicine and Surgery hitherto given are replaced by a single course on each of those subjects. Hospital attendance begins in the third year of training. There are four examinations to be passed for this degree, viz., one at the end of the first, third, fourth and fifth year, respectively. At these examinations the bye-laws rule that successful candidates must obtain one-half the marks in Anatomy and Physiology at the second M.B. and in Surgery, Medicine and Midwifery at the final M.B. examination. For the other subjects the old bye-laws which prescribe successful candidates obtaining one-third marks in each subject or one-half of the aggregate number of marks still hold. An addition has been made to bye-law No. 237 (*g*), which will no doubt be fully appreciated by students. This addition provides that candidates who fail to pass the final M.B. and C.M.

examination, but who obtain 60 per cent. of the marks in any two of the groups of Medicine, Surgery and Midwifery may claim to be exempted from re-examination in any two of these groups.

Acting on the recommendation of the General Medical Council of Great Britain and Ireland, bye-law No. 237 has been revised, but only as regards M.B. and C.M. students. According to this revision M.B. students must obtain one-half of the marks in Medicine, Surgery and Midwifery to secure a pass. This comes into operation at the ensuing second M.B. and C.M. examination.

APPENDIX B.

NOTE ON SERO-DIAGNOSIS IN ENTERIC FEVER.

By Surgeon-Major J. Smyth, M.D.

This method was first described by Dr. Widal of Paris in June 1896.

It may be carried out in one of two ways which are termed, respectively, the *quick* and the *slow* methods.

I. *The Microscopical method.*—This is done with the aid of a microscope. The quarter-inch object glass is the best power to use. Clean the patient's finger well with a little weak carbolic lotion. Draw blood by means of a needle prick. Have a clean slide on a chair close to the patient. By means of a platinum loop sterilised in the lamp flame convey a drop of the blood to the slide placing it thereon a little to one side of the centre. Then place on the spare surface of the slide close to the blood nine drops of neutral bouillon. These 'drops' should also be transferred by means of the platinum loop. The blood and bouillon are then intimately mixed by means of the loop. This makes a $\frac{1}{10}$ dilution of the blood. Take a clean $\frac{3}{4}''$ coverglass. Place on it, side by side, a loopful of the dilution and a loopful of a 24-hours bouillon culture of Eberth's (Typhoid) bacillus. Mix well by means of the loop. Place on a slide and examine at once.

If the blood be that of a typhoid patient in the second, third, fourth or fifth week of the disease, the reaction will in most cases appear almost instantaneously. Within one or two minutes, the bacilli, instead of moving rapidly as when they are in presence of non-typhoid blood, become sluggish, and, in many cases, motionless. They run together as if by some force of attraction, and form clumps of various sizes. This is called the *agglomeration phenomenon.* The agglomeration may be so complete in some cases that after a very short space of time, say five or ten minutes, hardly any bacilli remain free between the clumps. In very rare cases it may take an hour or two before the agglomeration is complete.

The agglomerated bacilli though motionless are by no means killed; if kept under favourable conditions, they retain their normal appearance, and even grow and multiply forming long filaments.

It must be carefully borne in mind that healthy blood will react like typhoid blood if not sufficiently diluted. It is very rare for healthy blood to show the agglomeration phenomenon when used diluted in the proportions given above. To avoid all fallacies Grünhaum advises a dilution of $\frac{1}{20}$ instead of $\frac{1}{10}$ as recommended by Widal.

II. *The Macroscopical method.*—This does not require the use of a microscope. It may be done in two ways—

(i) Add the serum or blood of the patient to a young bouillon culture of the typhoid bacillus in the proportion of 1 : 10 or thereabouts, using a very narrow test tube for the purpose. After two or three hours there will be an abundant precipitation of agglomerated bacilli, settling down as a distinct sediment of small clumps of bacilli.

(ii) A clearer but slower way is to take a small tube of sterilised bouillon, and add blood or serum from the patient in the proportion of 1 : 10 roughly. Inoculate this mixture with typhoid bacilli and incubate at 37° C. for 20 hours or so. If the blood has been taken from a typhoid case, the culture medium will then be found clear or nearly clear, while the bacilli will be seen lying in clumps at the bottom of the tube.

But if the blood has not been typhoid blood, the medium will be found quite turbid and there will be little or no sediment at the bottom of the tube.

But in September 1896 Widal showed that dead bacilli reacted to typhoid serum in the same way as living ones did. Wright and Semple * of Netley have enlarged on the great practical importance of this new fact. They show how it places the sero-diagnosis method within the reach of every physician, for, while it is impossible for every physician to keep a stock of live bacilli, it is a very easy matter to procure and keep capsules of the dead organisms with which the test can be equally well carried out. As regards the diluting of the blood, it does not appear that bouillon is absolutely necessary. Normal saline solution does equally well. Space does not permit of a full discussion of typhoid sero-diagnosis, but the following further points may be noticed.

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* *British Medical Journal*, 15th May 1897.

No one knows what causes the agglomeration of the bacilli. Gruber thinks it is due to a substance he calls *agglutinin.* The blood of typhoid patients retains its power of causing agglomeration for a considerable time: in very rare cases for even a year. Dried typhoid blood when redissolved gives the reaction. Blood may be drawn in capillary tubes and sent to a distant laboratory for the purpose of being tested. Even partial putrefaction is no bar to the test being applied. Blister fluid acts just like the blood.

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